UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960

May 13, 2004

10114897

MEMORANDUM

SUBJECT: First Five-Year Review Report
Piper Aircraft Superfund Site
Vero Beach, Indian River County, Florida

FROM: Jamey Watt, RPM

THRU: Jim McGuire, Chief
Section D

Carol Monell, Chief
Superfund Remedial and Technical Support Branch

TO: Winston Smith, Director
Waste Management Division

Attached please find a copy of the First Five-Year Review Report for the Piper Aircraft Superfund Site in Indian River County, Florida. Section 121(c) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended requires that if a remedial action is taken that results in any hazardous substances, pollutants, or contaminants remaining at a site, the Environmental Protection Agency (EPA) shall review such remedial action no less often than every five years after initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented.

The ROD selected remedy for the Piper Aircraft Superfund Site included groundwater extraction and treatment via air stripping. The technology selected was an EPA approved alternate technology that consisted of an in-well aeration and stripping system. This Five-Year Review concludes that, while the present system is protective, it is remediating the groundwater at a slower rate than anticipated. Piper Aircraft intends to augment this system by implementing a bioremediation pilot study. The triggering action for this statutory review is the Preliminary Close-Out Report dated September 21, 1998.

The Report has gone through EPA Region 4 and FDEP review. Based upon this review, it has been determined that the remedial action taken at this Site continues to be protective of human health and the environment. At this time we are seeking the Division Director's approval of this document.

Approved by: Winston A. Smith Date: May 13, 2004

First Five-Year Review Report for
PIPER AIRCRAFT NPL SITE
The New Piper Aircraft, Inc.
Vero Beach, Indian River County, Florida

December 2003

<u>Prepared by:</u> <u>Date:</u>

Jerry L. Young, 3/11/04
Manager, Environmental Sciences

Lars E. Persson, PG # FL 0001068 3-11-04

Prepared for
U.S. Environmental Protection Agency, Region IV

<u>Approved by:</u> <u>Date</u>

May 13, 2004

LIST OF ACRONYMS

ARAR	Applicable, or relevant and appropriate requirements
CERCLA	Comprehensive Environmental Response Compensation & Liability Act
CVB	City Of Vero Beach
COC	Contaminant Of Concern
EPA	Environmental Protection Agency, Region 4
FAC	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FS	Feasibility Study
GPM	Gallons Per Minute
IRC	Indian River County
MCL	Maximum Contaminant Level
MGD	Million Gallons Per Day
NewPiper	The New Piper Aircraft, Inc.
PPB	Parts Per Billion
PPM	Parts Per Million
RA	Remedial Action
RCRA	Resource Conservation & Recovery Act
RD	Remedial Design
RI	Remedial Investigation
ROD	Record Of Decision
VOC	Volatile Organic Compound

ISSUES

- During the operational lifespan of this project, the pump and treat remediation equipment has not performed to the approved levels as set forth in the design phase of the project. An important and on-going issue, has been the attempts at cost-effective design modifications of the existing electrical and mechanical hardware to approach and attain the level of expected efficiency originally intended for the project.

- Given the operational history of the past 5 years of remediation system operation, the "circulation cell" technology theory for the two UVB Wells has not performed as originally envisioned. A combination of misinterpreted geology/hydrology and groundwater quality featuring relatively high iron content is responsible for the lack of development of the anticipated circulation cells around the subject UVB Wells. This also has affected the return of treated groundwater to the aquifer limiting the quantity of contaminated groundwater that can be pumped.

- An issue to be determined is the efficiency/cost benefit of augmenting the pump and treat technology presently in place with bioremediation, (accelerated passive attenuation). This will better address contaminant plume cleanup to ARARS in identified "hot spots" in down gradient plume locations.

RECOMMENDATIONS

- Perform a comprehensive geochemical analysis of site groundwater conditions as a preliminary step for Bioremediation planning and design.

- Perform groundwater quality data collection using GeoProbe methodology in areas of incomplete plume mapping.

- Construct additional groundwater monitor wells based on GeoProbe data interpretation and 5-Year contaminant isopleth review.

- Develop plan for remedial modification employing Bioremediation Pilot Study.

PROTECTIVENESS.

- Groundwater quality monitoring since contamination investigations were initiated in 1992 with the Remedial Investigation (RI), indicates that the plume retains its original outline horizontally except in the source area which, has tested below Maximum Contaminant Levels (MCLs) for Constituents Of Concern (COC). Overall, the plume has experienced some degree of natural attenuation resulting in lowering of COC values and continues to be drawn into the capture zone generated by City of Vero Beach (CVB) Well #15. The depth-seeking behavior of residual contamination, the strategic location of Well #15 together with some degree of remediation by the pump and treat system, *will* furnish a considerable degree of public protectiveness. The previous groundwater remediation system surface-water discharge of treated effluent into the Main Relief Canal has been permanently discontinued.

LONG-TERM PROTECTIVENESS

- It is believed there are no long term protectiveness issues associated with plume migration and capture by CVB Well #15. The down-gradient areas from CVB Well #15 have no private wells as the City of Vero Beach provides municipal water. The CVB Municipal Water System pumps slightly contaminated raw water from several wells including CVB Well #15. The water from these wells is treated by an aeration system and monitored at the City of Vero Beach Water Treatment Plant. As remediation continues, exposure pathways are diminished.

OTHER COMMENTS

- None

First Five-Year Review Report for
PIPER AIRCRAFT NPL SITE
The New Piper Aircraft, Inc.
Vero Beach, Indian River County, Florida

TABLE OF CONTENTS

Appendices

Executive Summary

The New Piper Aircraft, Inc. (New Piper) is located at 2926 Piper Drive, Vero Beach, Florida on the southeast corner of the Vero Beach Municipal Airport in Indian River County, Florida. The facility consists of an 84-acre complex that includes buildings used for primary manufacturing of general aviation aircraft for worldwide sales, see Figure l. In 1978, the City of Vero Beach discovered Trichloroethylene (TCE) during routine sampling of water supply production Well # 15, located south of New Piper. The source of the TCE was traced to New Piper emanating from an underground tank system that was installed in 1975, see Figure 2.

In June 1989, the tank system was removed and the soil surrounding the tank excavated to a depth of 14 feet below land surface, treated and returned to the excavated area. An Extraction Well and Aeration System was installed in 1979 for the purpose of treating the contaminated groundwater. In 1981, the system was placed into service by a Consent Order agreement with the Florida Department of Environmental Regulation (FDER). The groundwater was processed by aeration via a spray-bar setup over a nearby canal. This operation removed contaminants from recovered groundwater, however the main body of the plume had developed in a southeast direction in response to the regional groundwater gradient and cone of influence around CVB Well # l5. The USEPA performed a Remedial Investigation & Feasibility Study (RI/FS) during 1992 & 1993. A baseline risk assessment and Record of Decision (ROD) were realized by December 1995.

A Supplemental Investigation & Feasibility Study was conducted by the New Piper Aircraft, Inc. (New Piper) and completed in 1997 that resulted in the construction of two circulation cell technology (UVB Well) pump and treat systems, to address the source area and plume contamination cleanup, see Figure 3. These systems were placed into operation in Fall of 1998 and have operated during the past five years with modifications in location, equipment and pumping rates.

This five-year review of operations and data indicate, the plume of TCE and degradation products maintain the same general Isopleth outline as when first mapped. Average constituent values are lower, the plume has changed to a non-detect status for approximately 150ft. down-gradient from the original source of contamination and the pump and treat UVB wells are contributing slowly to the lowering of constituent levels in hot spot locations.

The pump and treat systems have limitations in taking residual constituent values to the very conservative ARAR levels. In conjunction with a continuation of the present UVB well systems, New Piper is developing plans for a pilot program in accelerated bioremediation of a hot spot area. The program develops a pattern of injection points for pumping a food-grade proprietary liquid product into the desired depth zones. The liquid provides a slow release of either oxygen or hydrogen depending upon the type of bacteria present. Existing bacteria use the elements in an accelerated metabolism enabling them to breakdown the contaminant molecules to carbon dioxide and water. Risk assessment and monitor only status could follow the expanded bioremediation phase and possibly qualify the site for closure status.

I. Introduction & Purpose

The purpose of the Five-Year Review is to determine whether the remedy at the Piper Aircraft NPL Site is protective of human health and the environment. The methods, findings and conclusions of reviews are documented in this report. Additionally, the report will identify issues found during the review, if any, and identify recommendations to address them.

Personnel of the New Piper Environmental Sciences Department in conjunction with EPA Region 4, prepared this Five-Year Review pursuant to CERCLA 121 and The National Contingency Plan (NCP). The review was initiated in January 2003 and completed in September 2003.

The Five-Year Review is required because hazardous substances remain at the site above levels specified in the Record of Decision of December 1993. This is the first Five-Year Review for this site. In the past five years, issues and recommendations have evolved as a result of data interpretation and remediation equipment experiences.

II. Site Chronology

1. 1975 - Installation of Trichloroethylene (TCE) storage and supply tank system by Piper Aircraft Corporation (PAC).

2. October 1978 - Discovery of TCE contamination in City of Vero Beach (CVB) Well #15. Investigation revealed the contamination source as an underground storage tank system located at PAC.

3. March 1979 - CVB in conjunction with PAC and the Florida Department of Environmental Regulation (FDER), developed a groundwater remediation system using "Pump and Treat" technology. The system included a 6" by 60' deep extraction well discharged through a spray header over the flood control Main Relief Canal south of the property.

4. March 1981 - FDER proposed Consent Order authorized pumping of the remediation system. Issuance of the NPDES permit from EPA was deferred pending collection of additional data.

5. October 1981 - PAC signed a Consent Agreement with FDER for the Remediation of the TCE site. Pumping of the system continues with success in reduction of TCE levels through June 1989.

6. June 1989 - A Contamination Assessment was performed and PAC removed the UST and contaminated soil in the spill area, treated the soil and returned soil to the excavation. Pumping of the remediation system continued.

7. February 1991 - Environmental Protection Agency (EPA) listed Piper Aircraft TCE Spill Site on the National Priorities List (NPL) because of remaining groundwater contamination.

8. July 1991 - Piper Aircraft Corporation (PAC) files for Chapter 11 bankruptcy protection.

9. August 1992 - EPA contracted Roy F. Weston, Inc. to perform a Remedial Investigation/ Feasibility Study (RI/FS) and Risk Assessment.

10. December 1993 - EPA issued a Record Of Decision (ROD) that called for pumping and treating the contaminated groundwater by air-stripping and the treated groundwater would be discharged to an onsite drainage canal.

11. October 1994 - EPA issued NPDES Permit # FL0037036 to discharge treated groundwater to the Main Relief Canal that flows to the Indian River.

12. July 1995 - Piper Aircraft Corporation (PAC) emerges from bankruptcy and is renamed, The New Piper Aircraft, Inc. (New Piper).

13. June 1997 - New Piper completes a Revised Supplemental Investigation and Feasibility Study on the Piper Aircraft NPL Site as a base to design an improved groundwater remediation system.

14. January 1998 - Construction was initiated on an in-situ vertical circulation cell technology system, Vacuum-Vaporized-Well - UVB (German: Unterdruck-Verdampfer-Brunnen). Two systems were installed, (1) in the contamination source area - UVB-1, and (2) at the southeast edge of the contamination plume - UVB-2.

15. May 1998 - Construction start-up activities through this time indicated the UVB Well flow rates were approximately 1/2 (UVB-1) and 1/3 (UVB-2) of the final design flow rates of 44 Gallons Per Minute (GPM) and 52 GPM respectively.

16. May 1999 - First Year First Quarter (1999) UVB System Operation Report indicated various system and equipment failures, mostly related to the limited treated effluent flow limitation (flow rate) return to the aquifer. This problem is similar in both UVB systems.

17. June 1999 through May 2001 - Various EPA approved minor modifications to the UVB systems were completed to improve system flow rates.

18. February 2001 - EPA approved recovery well UVB-1A to be constructed because of the non-productive contaminant recovery history of UVB-1. Other minor system upgrades continued.

19. November 2001 - UVB-2 sub-surface vault Aeration System was replaced with an above-ground Aeration System, similar to UVB-1 because of continued problems with equipment malfunctions and flow rate. Additionally, an underground treated effluent discharge line was routed to the "Old Piper Extraction Well" to increase system pumping rate.

20. December 2001 to Present - UVB-1 and UVB-2 Systems have operated continuously with some minor equipment casualties and system adjustments. Routine maintenance of the Aeration Units and well screens to remove iron deposits are completed as needed.

III. Background

1. General

The Piper Aircraft NPL Site is an EPA listed Superfund site and was selected in accordance with the Comprehensive Environmental Response Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986, SARA 42 U.S.C. Section 9601 et.seq. and to the extent practicable, the National Oil and Hazardous Substance Pollution Contingency Plan (NCP). This decision was based on the administrative record for this site.

2. Site location & Description

The site is located at 2926 Piper Drive, Vero Beach, Indian River County, Florida. As depicted in Figure 1, the New Piper Aircraft, Inc. (New Piper) facility was constructed adjacent to the southern part of Vero Beach Municipal Airport in Indian River County. The New Piper facility consists of an 84 acre complex including buildings used for primary manufacturing of general aviation aircraft, aircraft parts, assembly, upholstery, tooling, painting, parts storage, training and administration. Figure 2 shows the portion of the site that has been the focus of previous investigations and on-going remediation compliance.

3. Geology

A. Regional

Indian River County is underlain by several thousand feet of marine limestone, marly limestone, dolomite, shale, sandstone and anhydrate, representing portions of the Mesozoic and Cenezoic time periods. The formations dip slightly southeastward in the Indian River County area. These shelf deposits un-conformably overlie a complex of Paleozoic, and Pre-Cambrian sedimentary and igneous rocks forming the central stable platform of Florida. Overlying the variously diagenetic sedimentary formations of Mesozoic and Cenozoic age is a relatively thin wedge of unconsolidated silicic and carbonate clastics including clay, silt, calcarenite and shelly sands of post-Pliocene to Holocene in age. These sediments comprise an approximate thickness of 100ft. in the New Piper area, see Figure 4.

B. Site Geology

The site geology pertinent in this project include the uppermost one hundred feet of unconsolidated sediments which were developed on a broad marine shelf (Atlantic Coastal Plain), with the deposition of both clastic and precipitate sediments taking place. The areal extent of sediment types was governed in part by reef occurrence, erosion, current direction and isostatic sea level change. The relatively fine-grained sediment types underlying the site resulted from long periods of low energy conditions of deposition. Within the sequence of identifiable layers , there are distinct beds of limited horizontal extent, demonstrating brief rapidly changing geologic and/or oceanographic conditions.

The coarsest textural aquifer materials occur in the twenty-five foot zone overlying the Hawthorn clay formation, approximately 95 to 70 feet below land surface. These materials are *calcarenitic* sands and occasional gravels of the Anastasia formation. In places, weathered remnants of the eroded Tamiami limestone formation inter-finger with this lower unit of the Anastasia, and probably provided a source of materials making up the unconsolidated to poorly cemented Anastasia beds. From about seventy to fifty feet below land surface, fine-grained, silty, shell fragment sands with thin beds of olive gray green clay occur. Within this zone, occasional partly-cemented zones are found. Sorting is poor and clay is both inter-bedded and matrix.

From fifty to twenty-eight feet below land surface a slight increase in sand texture and shell size fragments is seen in certain layers, providing an overall slight increase in permeability compared with the sediment zone immediately below.

Fine to very fine silty silica sand with traces of fine shell fragments occur from approximately twenty-eight feet below land surface to land surface. Figure 4A provides a generalized geology of the New Piper site.

4. Hydrology

The New Piper site lies within the southeast sector of the City of Vero Beach municipal well-field. All groundwater flow phenomena unique to the site are affected by area well-field pumpage from the surficial aquifer.

The surficial aquifer underlying the New Piper site exists under semi-confined water-table to semi-artesian conditions. This condition is a result of the interbedded occurrence of permeable silty sands and silty, clayey aquitards within the layered sequence. The stratigraphy creates an anisotropic ratio of horizontal to vertical hydraulic conductivity of approximately 10:1. This ratio was employed by project environmental consultant of record, Dames & Moore, Inc. following a literature research of area hydrologic publications.

Aquifer coefficients of transmissivity and storage vary depending upon the depth of screened wells from which pumping test data is collected. The most productive portion of the aquifer immediately overlying the Hawthorn clay (aquiclude), has transmissivity in the 20,000 to 40,000 gpd/ft. range. The upper portion of the aquifer has a typical range of 1,500 to 3,000 gpd/ft. These values were interpreted from data collected during investigative stages of this project and agree with data developed during City of Vero Beach tests at production well construction.

Historical data suggests an approximate contaminant movement velocity of 1.0 ft/day based upon the probability that the TCE tank piping system leaked soon after installation and that the first evidence of a disolved-phase plume contamination was detected at the City of Vero Beach in Well #15 approximately 670 days later, and 1,050 feet from the source tank location.

In the vicinity of the site, the aquifer has an average, approximate water-table depth of eight feet below land surface and a saturated thickness of approximately 87ft.

Water-table depths below land surface vary approximately three feet from wet season maximum to dry season maximum. The water-table gradient is from northwest to southeast with groundwater flowing toward the Indian River located approximately two miles east of the site.

The City of Vero Beach Well #15, located 300 ft. southeast of the New Piper site, and 1050 ft. from the leaking UST system, has a cone of influence of approximately 1200 ft. as observed in site monitor wells. Well #15 produces in the range of 300 gallons per minute and steepens the water-table gradient in the vicinity of the contamination plume, especially southeast of monitor well MW-19, see Figures 5,6, and 7. The water-table gradient as measured in shallow and intermediate depth monitor wells, (0 to 60ft. BLS), varies between 0.006 and 0.009 from west to east across the site. The gradients determined from deep well data (deeper than 60ft. BLS) vary between 0.004 and 0.011 (end of wet season data12/03). Water-table fluctuations in response to dry season/wet season variations have no demonstrable affect upon contaminant flow phenomena. Figure 8, is a vertical cross section along the approximate plume axis showing concentration of Vinyl Chloride (VC), seeking deeper zones of the aquifer *possibly* in response to a relatively higher average hydraulic conductivity below an approximate depth of 70 feet below land surface than above that depth *and* the influence of CVB Well #15 pumpage. Over the five year period it can be seen that the area of highest VC values has moved deeper and farther east and has been reduced in concentration to about one-seventh of that recorded in 1999. An exception to this trend is located in the 30 to 40 foot depth range between wells MW-19 and MW-23D. Sampling over the five year period has indicated occasional higher values for VC than found in deeper wells in the same general area. It is possible that a discontinuous hardpan overlain by thinly bedded silty clay creates a "perched" structure holding *contaminants* for intermittent leaching at its eastern margin. Such random structures are common in the shallow aquifer stratigraphy and mark temporary water-table elevation stands in response to changing sea level elevations during Pleistocene time. This possible structure could be influential along with decreasing distance from City of Vero Beach Well # 15, in the steepening of the groundwater gradient in the same area, see Figure 7. Additional Geoprobe and Monitor Well construction will be proposed for this area to more accurately interpret plume configuration and dynamics.

5. Site History

Piper Aircraft Corporation used TCE stored in an underground storage tank (UST). The tank was installed in September 1975 and became operational in January 1976. In October 1978, TCE was detected in the City of Vero Beach Well #15 located 1050 ft. southeast of the TCE storage tank. Use of Well #15 was discontinued at that time. In October 1978, samples of shallow groundwater adjacent to this tank revealed a TCE concentration of 39,000 parts per billion (ppb), (U.S. EPA 1993). It was determined that a fitting on the tank had been leaking. The volume of contaminant leakage was not determined because the duration and rate of leakage were not known.

In June 1989, the USTs were removed and soil excavated to a depth of 14 feet below land surface. A total of 740 cubic yards of Trichloroethylene contaminated soils were "Land Farmed" with aeration for six weeks.

Subsequent soil sample analysis was below the Maximum Contaminant Level (MCL). The soil was then returned to the excavation. No free product was encountered during the excavation and the water table was not encountered to a depth of 14 feet below land surface. The Extraction Well cone of influence had dewatered the area below the depth of the excavation, thus no effect on groundwater contaminants. International Environmental Services of Plant City, Florida designed and supervised tasks during this project.

Two new CVB water supply wells, CVB #19 and CVB #20 were installed to replace Well #15. Both of these wells are located south of the main relief canal, approximately 2,000 feet southeast and 2500 ft. south of Well #15, respectively, see Figure.8. Groundwater analyses from these wells during their operational histories indicated no constituents of concern above MCL.

A six-inch diameter extraction well was installed adjacent to the tank site in 1979 for the purpose of groundwater remediation at the source area. This well was screened from 10 feet below land surface to 60 feet below land surface with 80-slot screen. The pumpage of approximately 200 gallons per minute was discharged via a mile long pipeline to a spray-header assembly installed across a flood control canal., see Figure 9. Initial pumping of the Extraction Well began in April 1981 with effluent sample analysis detecting TCE at 3,006 ppb , and increased to 10,673 ppb by June 1981. By April 1982, the TCE concentration had declined to 876 ppb. Appendix C details Extraction Well performance from April 1981 through October 1994. Extraction Well effluent quality analysis for 1993 and 1994 are included.

The total amount of contaminants removed during the period April 1981 through February 1992 was approximately 1,162 pounds. This calculation by Harbor Branch Laboratory of Fort Pierce, Florida is the only calculation of total contaminants removed performed during the Extraction Well operational period. No groundwater quality information was recorded from the Extraction Well effluent from 1995 to final system shut-down in January 1998. During this period the well yield rapidly declined as a result of incorrect screen placement, pump placement and failed attempts at well re-development.

The Extraction Well system was shut down following the recommendation of Dames & Moore, Inc. of Boca Raton, Florida (Environmental Consultant), because of potential interference with the flow patterns of the UVB-1 Well system located approximately 220 feet East of the extraction Well. At the time of final shutdown of the Extraction Well, well yield was recorded at 70 gallons per minute.

A monitor well, MW-2 (89) was installed east of the extraction well and adjacent to the entrance of a loading dock. This well was screened from 19 to 29ft. Below Land Surface (BLS).

Monitor well MW-1, also installed during the initial investigation was destroyed when the UST system was removed. Between 1979 and 1994, additional monitor wells were installed as contamination investigation proceeded. All monitor wells currently used for data collection are illustrated in Figure 10. In January 1995, a National Pollution Discharge Elimination System (NPDES) permit replaced the 1979 Consent Order agreement with the State of Florida.

In 1992 and 1993, EPA conducted a Remedial Investigation (RI) of the site, (USEPA 1993). A Record Of Decision evolved from the RI work and stipulated that contamination would continue to be treated by groundwater recovery and discharge of treated effluent to surface waters with the addition of other pump and treat facilities.

In January 1996, New Piper initiated a Remedial Design Work Plan to design and implement an improved pump and treat groundwater remediation system based upon Re-circulation Cell Technology. This system utilizes two Vacuum-Vaporized-Well (UVB), double-screened well systems with aeration units. The design was completed and construction began in January 1998. Upon startup of the UVB systems, the Old Piper Extraction Well pump and treat system employing the canal spray-header site was terminated and subsequently removed. The extraction well became a treated effluent aquifer return point from well UVB-2 in 2001. Between *March* 1998 and *the* present, the UVB well systems have operated continuously with the exception of time devoted to equipment repairs and corrective design, and construction upgrades including the installation of well UVB-1A. Re-development employing air-jetting surge tools & well-bore brushes has been performed on well UVB-*1 and the Extraction Well.* This process has increased well efficiency, however, iron precipitating within the wells rapidly plugs off the screens with a soft red mud effecting a lowering of pumping rates within a few weeks of the re-development event. Effluent relatively high in dissolved oxygen, promotes rapid iron precipitation both in the wells and aquifer materials.

When UVB-1 and UVB-2 Well Systems were placed in service in March 1998, both well systems experienced many shutdowns from a few hours to several days because of overly complex designed electrical controls. By the time these operational problems were analyzed and corrected, the wells pumping rates had progressively declined because of iron oxidation plugging the screens with soft red mud precipitate. There was no evidence of colonial iron bacterial action usually signified by filaments and festoons of red slime. The mud is removed from the screens by gentle air surging, allowing settling time for the turbidity to collect in the sumps, and gentle air lift pumping to remove the red precipitate from the sump.

In well system UVB-2, the above problems became compounded by failure of the casing well seal (Bentonite), and resultant upward stoping of effluent causing earth sapping under the well vault causing vault subsidence and effluent turbid with bentonite flowing at land surface. It is interpreted that a faulty gravel pack job left the upper part of the upper screen section (see Figure 12), exposed to bentonite seal material. When aquifer materials became resistant to the flow of effluent, the effluent took the path of least resistance runneling up around the ten-inch casing and escaping around the vault floor to land surface.

Figures 18 & 19 present an operational history of the two UVB wells highlighting significant reasons for system shutdowns including dates of periods to remove red mud from screen sections. The conditions leading to each well development and aerator cleaning were characterized by gradual loss of effluent flow which the receptor wells could accept without overflowing at land surface.

Well UVB-2, excepting original construction development, and the Extraction well were air surged and pumped into frac-tanks and tankers for one round of redevelopment.

Frac tank and tanker a greater percentage of dissolved oxygen than progressively deeper zones which could water was slowly disposed of in the Extraction well and UVB-1 wells. The development process had to be stopped whenever the Frac tanks and/or the tankers were full. The process was cumbersome and relatively costly. Only well UVB-1 has been redeveloped a third time employing shop air to remove soft mud from the screen producing red mud in drums rather than thousands of gallons of water to be disposed After lengthy trial and error well operation at different pumping rates, it is evident that the controlling factor in the amount of water processed is not dependant upon the maximum efficiency of pumping wells and attempts to gain hydrologic understanding through parameter measurements such as water levels or specific capacities, but upon the ability of the receptor wells to receive influent. For example, 40 GPM might be produced by Well UVB-1A with UVB-1 receptor well able to absorb this flow for three to six weeks before the screen sections have enough mud build up to reduce effluent flow to approximately three to five GPM. It has been found more effective to reduce inflow to the aerators to 20GPM at UVB-2 and 10GPM at UVB-1 for longer term well usage without as rapid screen build ups. In addition to iron values of 1.0 to 1.1 ppm furnishing raw material for turbid precipitation there is the other variable of the amount of dissolved oxygen in the effluent stream. This content can vary with aerator efficiency so that just after an aerator cleaning event, there could be a higher dissolved oxygen content as compared to a later time when aerator efficieny, (observed in inspection panels in the aerators), is lower. A high flow rate combined with a maximum amount of dissolved oxygen could precipitate more red mud in the formation faster than low flow and less efficient aeration. It was observed during the five year period that the shallow screened areas placed adjacent to materials of lower permeabilities than the deeper screened sections resisted effluent flow quite rapidly as if thin lenses of material became clogged with iron precipitate. Typically the water table to approximately thirty feet below ground level would have accelerate iron oxide formation in these zones. The shallow aquifer has the characteristic of decreasing iron content with depth until the basal Hawthorne formation is encountered.

No inorganic water quality analysis of effluent to receptor wells was collected. The month to month operational variables such as pumping rates, downtime periods, CVB Well-field fluctuations (Well # 15), and differing recharge rates near dry season / wet season maximums combine to make quantitative estimates of natural attenuation activity unfeasible

System performance reports and records have been submitted to EPA at regularly scheduled times.

6. Basis for Taking Action

In October 1978, testing of the CVB Well #15 revealed TCE contamination. The TCE was traced to a TCE underground storage tank system which had been installed at Piper Aircraft in 1975. Piper promptly removed all TCE from the tank. Tests had indicated the piping fixtures at the top of the tank were leaking. Well points were installed in the tank area confirming TCE contamination.

IV. Remedial Actions

1. Remedial Selection

The initial response to the discovery of TCE contamination in the soil and groundwater at the storage tank site in 1978 was the construction of one contaminant recovery well in 1979. In 1989 contaminated soil was removed, treated by aeration, and returned to the excavation.

The objective of the well construction was to remove groundwater contamination at the source. The effluent from this "extraction well" was treated by aeration through a spray-header bar arrangement installed across a flood control canal approximately one mile southeast of the site, see Figure 9. This system commenced operation in February 1981. No documented remedial selection process was apparent in these early responses to the discovered contamination. Piper Aircraft and FDER followed the recommendations of an environmental consulting firm Gee & Gensen, Inc., for this initial step in source area groundwater contamination reduction.

This pump and treat methodology with surface water discharge was employed until the UVB well system was implemented in 1998.

In 1992 -1993, the EPA conducted a remedial investigation (RI) of the site (EPA 1993). Groundwater impacted by Volatile Organic Compounds (VOC) was identified on and down-gradient of the site. In 1993, a Feasibility Study (FS) report issued by EPA identified six remedial alternatives to be evaluated (EPA 1993). Based on the FS results, EPA issued a Record of Decision (ROD) for the site on December 23, 1993 which chose remedial alternative GW3a, Ex-Situ Treatment with Effluent Discharge as the selected remedy for the site. In accordance with the ROD, the components of this remedy include:

a. Groundwater withdrawal using extraction wells
b. Treatment of groundwater via air stripping
c. Discharge of treated effluent to surface water
d. If necessary, treatment of air emissions

New Piper signed a Consent Agreement with EPA on November 7, 1995 which required New Piper to implement the selected remedy at the site. The Consent Decree also incorporated a Statement of Work Plan which provided additional detail regarding the remedial design, construction and operating processes.

Subsequent to the Consent Agreement, New Piper developed a Remedial Design Work Plan (RD Work Plan). An objective of the scope of work in the approved RD Work Plan was to review alternative and innovative technologies that could be used as either an adjunct to or replacement for the selected remedy in the ROD. New Piper characterized the nature and extent of the plume with a Supplemental Investigation and Focused Feasibility Study and requested that EPA approve the use of an alternate technology. The technology selected consisted of proprietary in-well aeration/stripping systems, (UVB Well), as an alternate to the approved system.

EPA agreed to the proposal and permitted New Piper to incorporate such technologies in the remaining Remedial Design and Remedial Action process.

2. Remedy Implementation.

Initial installation of the UVB wells and near monitor well clusters were completed January 23, 1998. UVB well development was completed on January 26,1998 and the installation of system components was initiated. Construction startup well yields were less than specified in the system design. Both UVB wells were re-developed during the last week in May 1998 in an attempt to improve the contaminant recovery rate. These re-developments were considered an extension of original construction development that appeared inadequate .

During the summer of 1998, site hydrologic aquifer parameters were reviewed to explain lower well production rates than those predicted in the project design phase. In September 1998, New Piper submitted to the EPA a final design document modification that outlined UVB construction modifications for the groundwater pumping portion of the UVB systems. In October 1998, the UVB Systems were placed in the operational phase of the project.

Another system improvement project was engineered in the first half of 2001. Well UVB-1 *never* had recovered any significant quantity of contaminant groundwater to date, see Table 1. The improvement project constructed well UVB-1A over a monitored "hot spot" of residual contamination near monitor well MW-14, see Figure 10. Well UVB-1 was redeveloped *to* remove soft iron deposits from the deeper screen section and converted to accept treated effluent originating from well UVB-1A. Because of the intermittent delivery from the aeration unit sump to the receptor well, UVB-1in this case, as well as a similar situation in well system UVB-2 and its receptor well, the Extraction Well water level measurements vary randomly depending upon which part of the aeration unit "sump pump" cycle is occurring. Water table contouring interprets mounding of approximately 80 feet diameter with 0.75 ft. closure elevation at UVB-1 from shallow and intermediate monitor well depths on 7/08/03. Deep well contouring of water level information shows closure of approximately 45 feet diameter and 0.66 feet of closure elevation.. Detailed geochemical sampling in order to assess intra-formational precipitation and/or progression of natural attenuation, has not been considered because of the complexities and interplay of geological, hydrological and chemical variables, many of which are difficult to quantify without considerable study more in the area of basic research than operational remedial activities.

3. Systems Operation & Maintenance

UVB-1 was designed originally in 1997 as a ten-inch diameter double-screened well, to pump contaminated groundwater from the deeper screen at 66.49 to 57.20 feet below land surface, and return treated groundwater to the shallow screen at 20.92 to12.07 feet below land surface, see Figure 11. An inflatable packer separated the two screen zones. Early groundwater sampling analyses indicated the deeper section (screen), did not produce contaminants for recovery. At

that time the upper and lower screen functions were reversed, however the shallow screen did not have sufficient available draw-down before dewatering, when pumped at the original design yield of 44 gallons per minute.
Re-development during the construction testing period in May 1998, did not increase the specific capacity of well *UVB-1* significantly. Numerous electrical problems plagued the UVB-1 system during the first year of operation because of unnecessary electrical circuit and design complexities. Frequent troubleshooting and simplifying the electrical cabinet has increased the reliability of equipment and maintained more consistent running conditions.

The well was operated in this *reverse* configuration at reduced rate of from approximately *5 to* 15 GPM until its replacement by well UVB-1A. This well system, placed in operation in July 2001, was designed to pump from a zone of contamination identified near monitor well MW-14 Deep. The well has been operational with no mechanical problems, a consistent record of contamination recovery for vinyl chloride since that time the well yield is governed by the volume accepted at the receptor well UVB-1. The treated effluent is returned to the aquifer in well UVB-1.

During the past five years, Well UVB-1 has been redeveloped twice to mechanically clear the well screens of iron encrustation, and the aeration unit has been disassembled twice and cleaned for iron removal. Well UVB-1A with a pump capacity of approximately 50 gallons per minute (GPM), has been operating between 6 and 15 GPM because the iron encrusted well screen of UVB-1 limits the treated groundwater return to the aquifer at higher flow. Recent re-development of UVB-1 employing air-jetting surge tools, well-bore brushes and a flexible *surge-block*, has significantly increased the accepted flow of treated groundwater return to the aquifer. This process has enabled the flow rate to be adjusted closely to the original design flow for a short period of time. The installation is monitored daily for selected flow rate, aerator vacuum, total running time, aerator efficiency and leakage. Since 9/19/03, UVB-1A has been operating consistently at 10 GPM. The receptor well UVB-1 lower screen will accept this low flow rate without overflowing up the ten-inch diameter casing at land surface.

Well UVB-1A is monitored monthly for pumping water level immediately following an aeration unit sump pumping event as a check on specific capacity as an indicator for scheduling potential redevelopment.

UVB-2 was designed in 1997 as a ten-inch diameter double-screened well, to pump contaminated groundwater from the deeper screen at 83.50 to 74.50 feet below land surface, and return treated groundwater to the shallow screen at 35.33 to 26.48 feet below land surface, see Figure 12. The two screen zones were separated by an inflatable packer. During startup operations the well produced approximately one-half of design capacity and the well was redeveloped. The redevelopment achieved no significant increase in treated groundwater return capacity. Contaminated groundwater was pumped from the lower screen and treated groundwater returned to the upper screen zone by gravity. Structural deficiencies in well design, construction technique, and overall project supervision, resulted in subsurface sapping of the bentonite casing sealant followed by progressive subsidence of the well vault. This condition caused the casing to bend, placing stress on pumping equipment in the well.

The belowground vault was left in place and separated from the casing, the casing was extended to above land surface and the aerator function was moved to a nearby aboveground aeration unit similar to the unit at UVB-1.

The treated groundwater discharge from the aeration unit is piped approximately one thousand feet to the unused Old Piper Extraction Well for gravity disposal, see Figure 13. This significantly improved reliability *and* the pumping rate of UVB-2. A high iron concentration of 1.1 parts per million (ppm), in the groundwater has necessitated pump removal on two occasions for cleaning and another time for screen redevelopment during the five year period. The aeration unit trays were also cleaned during these periods to maintain efficient aeration. The well currently operates at a pumping rate of 20 gallons per minute. This flow rate the Old Piper Extraction Well can accept by gravity flow without overflowing at land surface. The system is monitored daily for groundwater flow rate, aerator vacuum and running time. Additionally, monthly depth to water measurements are observed both in well UVB-2 and the Extraction Well.

V. Five-Year Review Process

1. Progress since last five-year review.

   This is the first Five-Year Review on this project.

2. Administrative Components.

   The New Piper Aircraft Five-Year Review team consisted of:

   Kurt Chapman – Director of Human Resources and Training

   Jerry Young - Manager, Environmental Sciences

   Lars Persson - Professional Geologist # FL 0001608, Environmental Sciences Technician.

   David Patton - Environmental Sciences Mechanic

3. Community Involvement.

   The local community was made aware of the Five-Year Review process by PUBLIC NOTICE in the local newspaper, PRESS JOURNAL, 1801 U.S. 1, Vero Beach, Florida.

4. Document Review.

   This review consists of relevant documents including the ROD, and all environmental consulting firm reports that discussed the contamination investigation, remediation planning and implementation. The five-year accumulation of groundwater quality information, geologic interpretations and remediation wells operational histories also were re-visited.

5. Data Review

Groundwater Monitoring

Water-table measurements using selected monitor wells, have been recorded weekly for the past five years and presented in quarterly reports in the form of piezometric surface maps and in tabular form.

From March 1998 through December 2000, 12 monitor wells were measured for water-table elevations, see Table 2. This data was submitted as part of the requirements for monthly, quarterly and semi-annual reports. In response to an EPA request, six additional monitor wells were added to the network of data points for water-table contouring starting in 2001.

Five years of pieziometric surface mapping indicate no change in groundwater flow direction at the site and no appreciable difference in water elevations from year to year. Small differences in elevation are related to periodic storm or drought events, regional municipal well-field water demand fluctuations, and the operations of CVB Well #15. When contouring on a 0.25ft.interval, cones of depression can be contoured around UVB -1A and UVB -2. A representative pieziometric surface map is located in Appendix A.

Groundwater Quality Monitoring

Since September 1998, quarterly groundwater quality samples have been collected from the influent and effluent of UVB-1 and UVB-2, and analyzed by an approved testing laboratory for Constituents Of Concern (COC), see Table 1. Additionally, semiannual sampling and analyses have been performed on 27 monitor wells that identify the contaminants in the plume area, see amended Table 3.

Groundwater quality data is represented in isopleth maps for three COCs: (1) Trichloroethylene, (2) cis 1,2-Dichloroethylene, and (3) Vinyl Chloride. The data is classified in three depth zones, (a) Shallow - 0 to 30ft in depth, (b) Intermediate - 30 to 60ft, and (c) Deep - deeper than 60ft. below land surface. The data is presented also in tabular form within the main body of all reports.

UVB well analyses are presented in a time/cumulative form in successive reports for easy comparison of developing trends in contaminant recovery.

Overall Groundwater Analysis

SBP Technologies, Inc. (UVB System vendor/consultant) had indicated during the design phase of the systems, that designated contaminant MCL should be attainable within two to five years of system operation. These goals have not been achieved although the contaminant trend has been characterized by decreases in COC concentrations.

Trichloroethylene

The 3 part per billion MCL for this constituent has been exceeded almost exclusively in the shallow groundwater zone near UVB-1, see Figure14. The persistence of this occurrence might be the result of a localized paucity of indigenous bacteria necessary for more complete conversion to the common breakdown products as seen in other parts of the plume. Figure 14, compares the outline of the 3 parts per billion (ppb) isopleths from the groundwater quality sampling event in January 1997, following the beginning of full operation of the UVB well systems, with the latest isopleth mapping from December 2002. The 1999 event is outlined in black, the 2002 in red. Since the start of remediation, the mapped area for Trichloroethylene has diminished to approximately one-half the area delineated in 1997. A combination of UVB-1 pumping with principal aeration occurring in the well casing and natural attenuation probably contributed to this isopleth configuration in the latest rendition.

cis 1,2-Dichloroethylene

Interpretations of cis-1,2 Dichloroethylene groundwater analyses over a five-year period show a gradual shift of concentrations above the 70ppb MCL from northwest to southeast. A hot spot of several hundred ppb in the vicinity of monitor well MW-14 reduced below MCL shortly after UVB-1A near MW-14 became operational. At the present time, the only interpreted occurrence of cis-1,2 Dichloroethylene above 70ppb is in the area between monitor wells MW-19 and MW-23 (I2). *In the past 5-years, cis-1,2* Dichloroethylene concentration has analyses values at monitor well MW-16 ranging from Non-Detect to higher than 70 ppb (MCL) suggesting that pockets of significantly higher than MCL contamination exists between monitor wells MW-14 and MW-16, and between monitor wells MW-16 and MW-19. The movement of residual cis-1,2 Dichloroethylene concentration appears to be intermittent and not continuous. The present configuration of monitor well depths and locations raises the question of possible deeper occurrences of contamination.

Lower concentrations in the area of well UVB-1 are probably associated with on-going degradation of Trichloroethylene by natural attenuation and small amounts retained in localized silty clays. Concentrations in the area of well UVB-2 have decreased four-fold during this five-year period, see Figure 15. The combined factors of CVB Well #15 pumping, natural attenuation, and progressive deeper movement of this constituent probably account for this development.

Vinyl Chloride

A five-year review of Vinyl Chloride data indicates a lowering of constituent concentrations in the contaminant source area, and in general throughout the plume. The two UVB well systems operating at approximately 20% of design capacity show different trends in groundwater analyses from 1999 to the present. UVB-1A near the source area has lower more consistent values for Vinyl Chloride than well UVB-2. Although both wells presently have approximately the same pumping rates, UVB-2 shows an increase in vinyl chloride especially from 2000 to the present, see Figure 16. Monitor well locations within the plume and screen depth are important factors influencing these performance measurements as well as a more consistent running schedule for UVB-2, See Figure 19.

A vertical isopleth cross-section compares constituent values from June 1999 and December 2002, see Figure 8. Predictably, in this 3.5 year period, Vinyl Chloride residuals moved down-gradient and deeper in the aquifer. Figure 16, shows the areal expression of this movement. The composite plume 1ppb isopleth has shrunk by about 10% from its initial mapping in 1997.

V.1 <u>Generalized Plume Condition</u>

Given the hydrologic parameters of fluid movement associated with the site, it is probable the bulk of contaminated groundwater was processed by CVB Well #15 in the time frame prior to the installation of the UVB remediation system. Some Individual monitor well records show increases and decreases in values with no apparent trend identified.

This could be characteristic of residual plume conditions, with isolated concentrations of constituents in small pockets of low permeability, retained selectively by occurrences of clay as thin lenses and matrix material within shelly, silty, fine sand beds.

From the extraction well area southeast to halfway between monitor well MW-2 (89) and monitor well MW-14 is interpreted as *possibly* being clear of contamination.
This condition has existed for approximately 2.5 years with no recurrence of contamination noted in monitor well samples above MCL, see fig.16. It is possible that residual contaminants could be present in zones deeper than the present monitor wells are screened.

A vertical isopleth cross-section compares constituent values from June 1999 and December 2002, see Figure 8. Predictably, in this 3.5 year period, Vinyl Chloride residuals moved down-gradient and deeper in the aquifer. Figure 16, shows the areal expression of this movement. The composite plume 1ppb isopleth has shrunk by about 10% from its initial mapping in 1997. The fourth constituent of concern listed in ROD as a cleanup performance standard, 1,1-dichloroethene, was not detected above detection limits in monitoring well samples collected from the site. No data for this constituent is included in the five-year review.

No data is presented for VOC emissions as aerator off-gasses because it was determined in 1997 that total compounds treated from the two UVB wells were below the minimum required for air permitting and reporting. Discussion related to air permitting is included in Appendix B.

VI. Site Inspection

The Five-Year Review EPA Site Inspection for this site was conducted January 7, 2003 by Jim Mcguire, Chief South Florida Section, EPA Region 4, and William C. Denman, PE, Project Manager, EPA Region 4. The team reviewed system operational data records and inspected the UVB well system installations. Another site inspection was performed by Jim Maguire (EPA, Region 4) and Jamey Watt (EPA, Region 4) on November 20, 2003.

VII. Interviews

- A Public Notice was placed in the Vero Beach Press Journal newspaper February 4 2003, that indicated the Five-Year Review was in process and invited input from the public.

- Mr. John Ten Eych of the City of Vero Beach (CVB) Water & Sewer Department was contacted regarding well performance and groundwater quality issues present at the CVB Municipal Well # 15.

- No other interviews were conducted for this Five-Year Review report.

VIII. Technical Assessment

A: Is the remedy functioning as intended by the decision documents?

The remedial objectives at the Piper Aircraft NPL Site are to limit plume migration and reduce groundwater constituent concentrations within the identified groundwater plume to achieve ARAR,s listed in the Record Of Decision, see Table 4.

The EPA approved methodology, UVB System (pump and treat operation), is working in a conventional configuration with the contaminated groundwater being extracted from the aquifer via screened wells, treated by aeration and returned to the aquifer in locations remote from the extraction point, but within the original defined plume area.

The "Circulation-Cell" concept has not worked as originally perceived. *Also,* because of the difficulty in returning treated groundwater at the original design flow rates at UVB-1 and UVB-2, of 44 GPM and 55 GPM respectively, the systems perform at lower rates and efficiency than originally predicted in 1997.

Post hydrologic interpretation/pre-UVB well construction consulting reports proclaimed that 60% of groundwater contamination would be below MCL's within two years and achievement of contaminant ARARs within a five year period. Five years of system operation and data collection/evaluation has indicated the above goals were not achieved, and the remedy is working at a much reduced rate from that intended by the decision documents.

Well System UVB-1 was constructed to reduce constituent concentrations in the up-gradient source area, and targeted Trichloroethylene in the shallow water-table zone. Repeated system Influent analyses indicated negative results for this COC, although the well was surrounded by monitor wells registering low levels of Trichloroethylene. It is believed that influent to the original design shallow well screen in UVB-1 was being aerated in the well casing. This action was occurring because the pumping water level in the well was below the well screen level and caused a cascading aeration of influent to the well before being pumped to the aboveground aeration unit tank. Had the pump been placed above the screen, the available draw-down would not have been sufficient to prevent rapid dewatering of the pump intake given the low specific capacity of the shallow zone.

Since the movement of the groundwater extraction point to well UVB-1A site in July 2001, contaminant recovery for cis-1,2-Dichloroethylene and Vinyl Chloride has been continuous. Influent from UVB-1A is piped to the aeration unit and the treated groundwater is returned to the aquifer in the original UVB-1 well. The flow rate has been restricted to approximately 15gallons per minute (30% of aerator capacity) by the quantity of treated groundwater well UVB-1 will accept. In addition to relatively low transmissivity of screened formations, the high iron content of area groundwater contributes to continuous and rapid plugging of screens and gravel-pack. Well System UVB-2 was located in a hot spot for cis-1,2-Dichloroethylene and Vinyl Chloride and a partial barrier location for the prevention of offsite plume migration. The "Circulation Cell" feature of this system design has not performed well because of low permeability in the upper screen zone (shallow aquifer), inter-bedded silt and thin clay beds in the overall geologic section, an approximate 10:1 horizontal to vertical flow anisotropy and a relatively steep groundwater gradient because of the close proximity to CVB Well #15. The system has operated at approximately one-third of its intended flow rate largely because of the inability to dispose of treated effluent into a receptor of sufficient permeability.

B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

The criteria used to develop exposure assumptions has changed since the original Risk Assessment performed by the Roy F. Weston Company in 1992. Specifically, the remedial action approved in 1993 included use of the aeration discharging to a nearby surface water body (canal). This method of effluent disposal was considered when exposure assumptions were developed. Human contact with treated effluent received a certain rating based upon the potential for persons to be directly exposed to spray, and under worst case conditions, exposure to potentially contaminated canal water at the discharge location.

When the UVB Systems commenced operation in 1998, the Old Piper Extraction well ceased operation and the canal discharge equipment was removed, the degree of potential human contact with contaminated groundwater lessened. Additionally, the contaminant constituents have moved deeper in the aquifer with lower concentrations in the past five years decreasing the potential for human contact. It is believed that the level of exposure assumption could be changed to a less conservative value without increasing the risk to human health and safety.

Within the context and intent of the Record of Decision, page 38 states: "The goal of this remedial action is to restore groundwater to its beneficial use as a potential drinking water source. Groundwater shall be treated until federal, and/or state groundwater standards are met". Within the context of that directive, the factors of toxicity data, cleanup levels, and remedial action objectives remain operative and viable.

C: Has any other information come to light that could call into question the protectiveness of the remedy?

DNAPL research has increased markedly over the past five years as this class of underground contaminants is being more seriously targeted for remediation.

It has become apparent that pump and treat methods in fine-grained sediments are limited in the removal of vinyl chloride to meet the 1 ppb MCL indicated in the ARARS. New Piper intends to augment the pump and treat system with a bio-remediation pilot study. The five-year review data indicates the protectiveness of the present methodology is working because of contaminant lower toxicity, mobility and volume, although slower than predicted because of inefficiencies implicit in the design, constructional supervision and misrepresented hydrologic interpretations of the selected methodology.

Technical Assessment Summary

A five-year review of groundwater sampling data indicates a lower average constituent concentration in the site subsurface with Trichloroethylene degradation products slowly moving deeper in an easterly direction (down-gradient), in the aquifer. Figure 8, is a vertical cross section illustrating this finding by comparing plume outlines for Vinyl Chloride from data collected in June 1999, and December 2002. It is evident that qualitatively the health and safety of the public is at somewhat less risk as it is more difficult to access contaminated groundwater when it occurs deeper in the aquifer. In addition to the well permitting process which prevents the construction of potable or irrigation shallow aquifer wells in an area serviced by municipal wells, the Indian River County Well-field Protection Ordinance furnishes additional security for the public by controlling all activities in circular zones around municipal wells. These factors decrease the probability of the public coming in contact with potentially contaminated groundwater.

There has been an overall reduction of contaminant concentrations for all COCs and an approximate 10% reduction in areal extent of the present limit of toxic concern during the past five years. No toxicity studies have been performed since the Roy F. Weston study of July 1993, to integrate the five year overall decrease in COC concentrations with modified or updated toxicity assumptions.

The occurrence of Trichloroethylene above the ARARs (3 ppb), is confined to a small area in the vicinity of well UVB-1. These residual remnants of the original plume have not demonstrated any downgradient movement with the groundwater flow, however the concentration has decreased, see Figure 14. Natural attenuation and well UVB-1 pumpage are the mechanisms thought to be responsible for this condition. Target cleanup levels will probably not be attained by pump and treat methodology within the next five-year period without possible input of oxygen or hydrogen enhancing, bio-remediative technology.

The residual quantity of cis-1,2- Dichloroethylene remaining in the plume above the cleanup level of 70 ppb appears to be *concentrated* in the area around monitor wells MW-22. With the exception of constituent concentrations during 2002, a downward trend in concentration over 5-years has been observed. Dispersion mechanisms, degradation to Vinyl Chloride, and some effect from wells UVB-2 and CVB Well #15 pumpage in this area possibly have combined to lower constituent volume significantly, see Figure 15. If the rate of decrease in constituent concentration remains constant for the next five years, it is possible the cleanup level of 70 ppb can be attained.

Vinyl Chloride is the most widespread constituent of concern with an MCL of 1.0 ppb. Residual zones of relatively high concentrations occupied areas around monitor wells MW-14 and MW-22 in 1998. The 1 ppb isopleth at the northwest end of the plume slowly moved down-gradient toward the southeast as wells MW-10, MW-2(89),and MW-12 tested below MCL by 2001. The 1 ppb isopleth is drawn just up-gradient from well MW-14D, see figure 16. At the end of this five year period, all COC concentrations have been lowered in various areal locations as well as depth zones. The capture zone of CVB Well #15 encompasses the entire plume, see Figures 20 and 21, and consistently has concentrations in single digit numbers. This reflects the mixing and resultant dilution of the plume water with the greater volume of water from other quadrants of the cone of influence. Because there are no historical records of when the Trichloroethylene pressurized tank system (contamination source), began operation more definitive than January 1975, and no record of chemical purchased versus chemical used was maintained, all estimated calculations regarding how much and when first leakage occurred are subject to considerable margins of error.

Groundwater flow calculations performed by the two separate consulting engineering firms responsible for the UVB systems yielded an estimate of 3 to 30ft./day. It was not specified at what distances from CVB Well #15 the various rates of flow could be assigned given the changing groundwater gradient away from CVB Well #15. When CVB Well #15 is operating, pieziometric mapping over the past five years has shown a marked increase in groundwater gradient starting in the MW-19 well area and increasing more rapidly towards CVB Well #15, see figures 4&5.

A conservative estimate of the rate of dissolved constituent flow assumes slow tank leakage from the time of installation, assume mid-year June 1975, until October 1978, when COCs were discovered in CVB Well #15 monthly sampling. The assumed time period of flow is 1095 days for a distance of approximately 1,200 ft.

These numbers yield one possible average flow rate for dissolved constituent of approximately 1ft./day. A data review shows groundwater flow estimates ranging from 3 to 30 ft./day. An unknown factor that is critical to reducing Vinyl Chloride contaminant levels in subsurface stratigraphy to ARARs, is the question of the critical mass of chemical necessary to overcome surface tension phenomena, and move the chemical into the groundwater stream of a given flow rate.

Because of this phenomena, is the small quantity of chemical remaining on clastic fragments concentrated enough to cause monitor wells to consistently register analyses above 1 ppb. Vinyl Chloride? The differing imprecise estimates for flow rates of groundwater versus dissolved constituent chemical flow rates at this site could be the critical hydrologic indicator for concluding that pump and treat methodology in this geologic setting featuring fine-grained elastics, cannot create the flow velocity sufficient to release and transport very small quantities of contaminant.

The UVB systems could be more efficient in lowering constituent values and decreasing mobility of residual contaminants if pumping rates could approach originally designed capacities. This has not been possible because treated effluent cannot be returned to the shallow aquifer at the system design flow rates. The thin beds and lenses of relatively fine-grained materials have limited storage capacities and provide delayed vertical leakage characteristics for groundwater flow. Also the high iron values of approximately 1 ppm causes the precipitation of quantities of red mud in aerator cabinets and well screens which further inhibit flow rates.

The widespread occurrence of TCE degradation products indicates bacterial activity in the subsurface. The persistence of TCE above ARARs near UVB-1 with minor amounts of cis-1,2 Dichloroethylene and Vinyl Chloride could indicate an area where bacterial activity is slower than average.

Natural attenuation is an on-going process which probably has contributed to *some* progressive lowering of constituent values. In the past five years, technical advances in the field of enhanced bioremediation offer cost/effective alternatives to pump and treat methods. It is planned to continue to operate the UVB systems and to plan and implement a pilot study using proprietary food-grade compounds which are injected into the subsurface. The subsequent slow release of oxygen or hydrogen depending upon bacterial requirements increases the bacterial population which in turn feeds on chlorinated solvents.

Five years of mechanical/electrical, labor-intensive activities associated with maintaining the present pump and treat facilities increases the attractiveness of a non-intrusive, passive technology which is proven effective.

IX. Issues

- To operate UVB-1 and UVB-2 systems efficiently as possible at flow rates that will continue to remove cantaminants.
- Development of a cost/effective method for treating the high iron content of influent and effluent to minimize well screen and aerator plugging.
- Select the most cost/effective and critical area for planning and implementation of a bioremediation pilot study.

X. Recommendations

- Plan a comprehensive site groundwater analysis to establish baseline chemistry to be utilized in bioremediation plan development.
- Perform Geoprobe site contaminant analysis in areas of insufficient plume monitoring coverage, and construct additional monitor wells as needed to improve plume monitoring.
- Plan an accelerated bioremediation pilot program in an area where both plume reduction and increased protectiveness are attainable.
- Reduce the frequency of water level measurements to monthly from the present weekly monitoring schedule.

All work associated with recommendations will be planned and managed by New Piper with contract vendors as needed. New Piper Environmental Sciences Department will coordinate all planned activity with the EPA Region 4, FDEP and other required regulatory agencies.

XI. Protectiveness

A review of five years of collected data, maintenance projects, and UVB system modifications indicates an increase in protectiveness of human health and safety by the following activities:

- Surface discharge of treated effluent has been terminated. Aerator facilities for both UVB wells are within fenced-in areas.

- The Constituents Of Concern above ARARs are deeper in the aquifer than previously reported in the Risk Assessment.

- The UVB systems have treated millions of gallons of area groundwater, and removed contamination in the parts per billion range.
- No contamination has been detected above ARARs between monitor well MW-14 and the Old Piper Extraction Well in the original contamination source area.

XII. Next Review

The next five-year review for the Piper Aircraft NPL Site is required by September 2008, five years from the date of this review.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960

November 3, 2003

Jerry L. Young
Manager, Environmental Services
The New Piper Aircraft, Inc.
2926 Piper Drive
Vero Beach, FL 32960

RE: **Comments to First Five-Year Review Report (DRAFT)**
Piper Aircraft NPL Site

Dear Mr. Young:

Thank you for your submittal of the First Five-Year Review Report (DRAFT). EPA and FDEP have reviewed the document and submit the following comments. The Five-Year Review process is intended, in part, to evaluate the protectiveness of the selected remedial action. According to the details in the report, EPA feels that modifications to the remedial action should be considered by Piper because the UVB wells do not appear to be operating properly and adjustments could be made in the location and monitoring of the monitoring wells to improve the systems efficiency. Please view this comment letter in two respects. First, comments on the report itself (listed mostly in Section 1.) should be addressed so the that the report can be finalized and approved by EPA. Second, comments concerning the potential modifications to the remedial action (Sections 2. through 5.) should be considered in any future work at the site. EPA requests to have a meeting with you at the site to discuss these comments and to ensure that progress continues as effectively and efficiently as possible.

POTENTIAL MODIFICATIONS TO THE REMEDIAL ACTION

Five elements are suggested for consideration in modifications to the remedial action. These elements relate to both the remedial technology selected and the monitoring of that remedial action. Also included are two steps that should precede the evaluation of alternative remedial actions. While these five elements are presented sequentially, there may be some advantage to implementing all or part of elements 4 and 5 ahead of steps 2 or 3.

1. Completion of the Five-Year Review Report
2. Comprehensive Geochemical Analysis
3. Evaluation of Potential Alternative Remedial Actions or Remedial Action Modifications
4. Modifications to Monitoring the Remedial Action
5. Location of Monitoring Wells

The first element for consideration in modification to the ground water remedy for the Piper Aircraft Site is revising the Five-Year Review Report. Changes to the report should consider comments provided in this memorandum report. Comments are as follows:

1.1 Under the **ISSUES** heading on page 3, in the fourth "bullet", there is a suggestion for "...a change of the MCL to a more realistic value." EPA's response is if the selected remedy is not functioning properly, or is functioning inefficiently, then a change to the remedy is indicated, rather than a change to the cleanup goals.

1.2 The statement in the last "bullet" under the **ISSUES** heading should be removed. The text suggests that it may be possible to revisit the risk assessment, with a "monitor only" protectiveness requirement for the future. EPA would not consider this or some other option that backs off the remedial action objectives in the ROD until after remedy optimization(s) occur and there is a formal determination made that attainment of those remedial objectives are not technically practicable within a reasonable time period.

1.3 The Five-Year Review either needs to remove references to the effects of DNAPL on contaminant migration at this Site or should provide a detailed discussion of the data and investigations that have lead to a determination that DNAPL is currently present. Unless there are more data presented in this report to demonstrate there is DNAPL present, rather than dissolved/adsorbed contamination, the references should be removed. The text references DNAPL (1) in the last "bullet" under the **RECOMMENDATIONS** heading; (2) in the discussion under the **PROTECTIVENESS** heading on page 4; (3) in the Executive Summary on page 8; and (4) elsewhere in the report. Based on EPA's review of the available ground water concentration data, the entire second through fifth paragraphs on page 24 need to be deleted. Note that vinyl chloride is not a non-aqueous phase liquid regardless of the presence or absence of DNAPL (which would be mostly TCE).

1.4 Under the **PROTECTIVENESS** heading on page 4, the phrase "..an unknown quantification of the pump and treat systems plume amelioration..." should be replaced by the more understandable "some degree of remediation by the pump and treat system."

1.5 Three changes need to be made to the text in the first paragraph under the heading Hydrology (Section 4) on page 12. First, the word "delayed" should be removed from the first sentence. Second "semi-artesian" should be replaced with "semiconfined." Third, the text refers to an anisotropic ratio of horizontal to vertical transmissivity. While this designation may be technically correct, it is more technically appropriate to describe the anisotropy with respect to the hydraulic conductivity, rather than the transmissivity. Also, some basis for making a statement that the ratio of horizontal to vertical hydraulic conductivity is 10:1 needs to be added. If this ratio is assumed based on a generalized indication from the hydrogeologic literature that it is applicable, that point should be stated in the text.

1.6 The third paragraph under the heading Hydrology on page 12 implies that DNAPL moved at an estimated rate of 1.2 feet per day and arrived at the City's Well #15 912 days later (essentially a distance of almost 1100 feet). The report needs to make the distinction between DNAPL (a non-aqueous phase liquid) and a dissolved-phase plume resulting from dissolution of contaminants from DNAPL or from some other contaminant source. Movement of DNAPL for 1100 feet would require a very large mass of DNAPL contamination, and would almost certainly be reflected by high concentrations of TCE across the entire length of the area of contamination. This scenario is inapplicable to the Piper Aircraft Site.

1.7 The lengthy text at the end of part 4 of the report's background section needs to be changed to remove the reference to vinyl chloride movement in response to density and to indicate the hydraulic conductivity and pumping factors that do influence vertical contaminant movement. Vinyl chloride will not move downward in response to a density differential as it is less dense than water. The apparent downward migration of the vinyl chloride is further evidence for vertical contaminant migration being largely controlled by the relatively high hydraulic conductivity near the base of the surficial aquifer (reference page 12, Section 4. Hydrology, second paragraph), and by pumping of the production well down-gradient of the Site, which further concentrates ground water flow near the base of the aquifer.

1.8 The report needs to include some additional discussion about the operation and effectiveness of contaminant removal of the extraction well that was installed in the vicinity of the leaking tank (reference the second paragraph of the site history discussion on page 13). Data presented in Table 3 of the report suggest that contamination at and near the extraction well has been greatly reduced from what were apparently the concentrations observed twenty or more years ago. It would be useful if there was some chronology of ground water concentration changes in the area of the source, along with some estimate of the total contaminant mass removed from the ground water by the extraction well. Also, the text should discuss any effect on ground water concentrations in the extracted water that may have occurred in response to the 1989 soil remedial action (reference text in Section IV.1 on page 14).

1.9 A summary is needed in this Five-Year Review Report of the periods when well rehabilitation was performed on the UVB well(s). This summary would describe conditions leading to each well rehabilitation, the dates of those rehabilitation periods, the geochemical environments (if known) that are responsible for the differing responses noted at UVB-1 and UVB-2 (reference the last paragraph of Section III.5. on page 14; the statement indicates that only UVB-1 has been redeveloped; however, the discussion on page 17 indicates that UVB-2 has also been redeveloped), and the response of the UVB well(s) to each redevelopment (i.e. the noted changes in pumping rate and/or specific capacity, with actual values presented).

1.10 The last part of Section IV.2. indicates that well UVB-1 was redeveloped and converted to accept treated effluent originating from UVB-1A. The amount of water being discharged into the aquifer through UVB-1, effects of that discharge on measured water levels, and effects of that discharge on concentrations measured in nearby monitoring wells needs to be discussed in the text. If there has been any monitoring of the quality of water injected into the aquifer at UVB-1 that relates to geochemical conditions affecting either iron encrustation or potential natural attenuation of chlorinated solvent contamination in the aquifer around UVB-1, that information also needs to be included in the discussion. A similar comment applies to the injection of the water that has been extracted from UVB-2 into the former Piper Extraction well (see the UVB-2 discussion at the close of Section IV on page 17).

1.11 On page 18, under the heading Ground Water Quality Monitoring, the report indicates that influent and effluent samples from the UVB wells have been obtained quarterly since September 1998. Table 1 only presents data from September 1998 to the fourth quarter of 2000. There should be data included from monitoring in 2001 and 2002. Data from replacement well UVB-1A are not included in the table and should be added.

1.12 In the discussion of the trichloroethylene contamination on page 19, the text references January 1999. Figure 14 indicates that one set of contours represents conditions in January 1997. This discrepancy should be corrected.

1.13 On page 19, the report states that at present, the only interpreted occurrence of cis 1,2-DCE above a 70 ug/L concentration is in the area between monitoring wells MW-19 and MW-23. Based on the December 2002 data, that interpretation is valid. However, data from MW-16 have periodically shown cis 1,2-DCE concentrations above 70 ug/L, most recently the June 2002 sample. It is unclear why the cis 1,2-DCE data from that well should show a great degree of variability, with low (or even nondetect) concentrations alternating with concentrations above the 70 ug/L MCL. Regardless of the cause, these periodic excursions of cis 1,2-DCE above 70 ug/L at MW-16 suggest there may be some significant cis 1,2-DCE contamination between that monitoring location and MW-19, or somewhat further upgradient than the 70 ug/L contour for December 2002 that is shown on Figure 15. The report text on page 19 should acknowledge there may be some more significant cis 1,2-DCE contamination for some distance upgradient of MW-19 that is not identified because of the absence of any monitoring wells between MW-16 and MW-19, or at the MW-16 location but deeper in the aquifer (note that Figure 8 suggests that more significant contamination is present around MW-16 but deeper than the screened interval for that well). FDEP made this same comment.

1.14 At the top of page 20, the text beginning in the first full paragraph ("Given the hydrologic parameters...") seems to be a transition to a series of summary statements on the results of ground water quality monitoring. As such, there should be a new heading added here to indicate it is a separate discussion from the vinyl chloride discussion that continues from page 19.

1.15 Under the heading **Technical Assessment Summary** on page 23, there is some confusing text in the fourth paragraph. The first sentence in the paragraph indicates that the residual quantity of cis 1,2-DCE above the 70 ug/L MCL appears to be "stalled" in the area around MW-19 and MW-22. It is not clear what is meant by this statement, but it could mean that concentrations of cis 1,2-DCE do not appear to be decreasing in that area. This point would conflict with later statements in the same paragraph, which indicate that cis 1,2-DCE is decreasing. The data presented in Table 2 of the report are ambiguous with regard to cis 1,2-DCE concentrations at MW-19 and MW-22S. Some rewording of this text is needed to produce a discussion that is consistent with the available data from recent monitoring of MW-19 and MW-22S.

2. Comprehensive Geochemical Analysis

Before recommending any specific changes to the remedial action, **a comprehensive geochemical analysis of the ground water should be done**, to establish the baseline conditions that may require modification in order to improve the remedy performance. This geochemical analysis should closely follow the geochemical data collection/analyses specified in Section 2.2.2 of the EPA Guidance Document *Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Ground Water* (EPA/600/R-98/128), with the exception that several of the anthropogenic contaminants listed in Table 2.3 of that document (e.g. dichloromethane) are not site-specific contaminants and therefore do not need to be evaluated. The guidance document is available at Internet address http://www.epa.gov/ada/pubs/reports.html.

Samples should be obtained from background monitoring locations, from locations in the upgradient part of the plume, from the mid-plume area (MW-16) and from the downgradient part of the plume, in areas that both are and are not (or are relatively not) within the treatment zone for the UVB wells. Monitoring from this variety of locations will allow for potential remedy modifications that are customized to address both localized variations in plume chemistry and the background water-quality conditions that would affect a remedial action that modifies the ground water chemistry. Note that the current conditions of operation of the UVB wells affects both the ground water chemistry and flow patterns around those wells, and at the two wells where treated water is re-injected into the aquifer. These effects will have to be taken into account when considering any modifications to the aquifer chemistry to enhance the in-situ treatment of contaminants. This comment was reiterated by the FDEP.

2. NewPiper Response :

A comprehensive geochemical analysis of site groundwater is a prerequisite for bioremediation planning. NewPiper has been in contact with REGENESIS Corporation in California for approximately three years by way of seminars, E-mail, bioremediation planning / program design software, and phone conversations with their technical staff.

The referenced EPA guidance document ,(EPA/600/R-98/128), will be obtained and incorporated into the planning for design of the proposed bioremediation pilot study.

It has been recognized by NewPiper personnel since the inception of the UVB pump and treat program that this methodology may not clean up the subject plume to ARARS in the required timeframe. It represented a positive and hopeful attempt at a time when alternate methodology did not appear as efficient and the fast developing area of passive accelerated bioremediation did not appear as feasible or acceptable at that time. Even if it were possible to place pump and treat facilities in an interpreted pattern of the highest efficiency of location and design, there would be no cost effective way to dispose of the quantity of treated effluent generated by the most ideal well arrangement.

3. Evaluation of Potential Alternative Remedial Actions or Remedial Action Modifications

Once the geochemical data are obtained, **evaluation of potential alternative remedial actions or remedial action modifications can proceed.** This step may take the form of either a proposal for a pilot test of an alternative remedial action, or may be the preparation of a focused Feasibility Study type of document. Any revised remedial action needs to do a better job of addressing the entire contaminant plume, rather than addressing only localized parts of the upgradient and downgradient parts of the plume. There is a substantial midsection of the plume that is poorly monitored and that can be more effectively remediated. Focusing the remedial action near the downgradient end of the plume and having the mid-plume contamination migrate into a downgradient treatment zone is not the most efficient way to remediate the ground water.

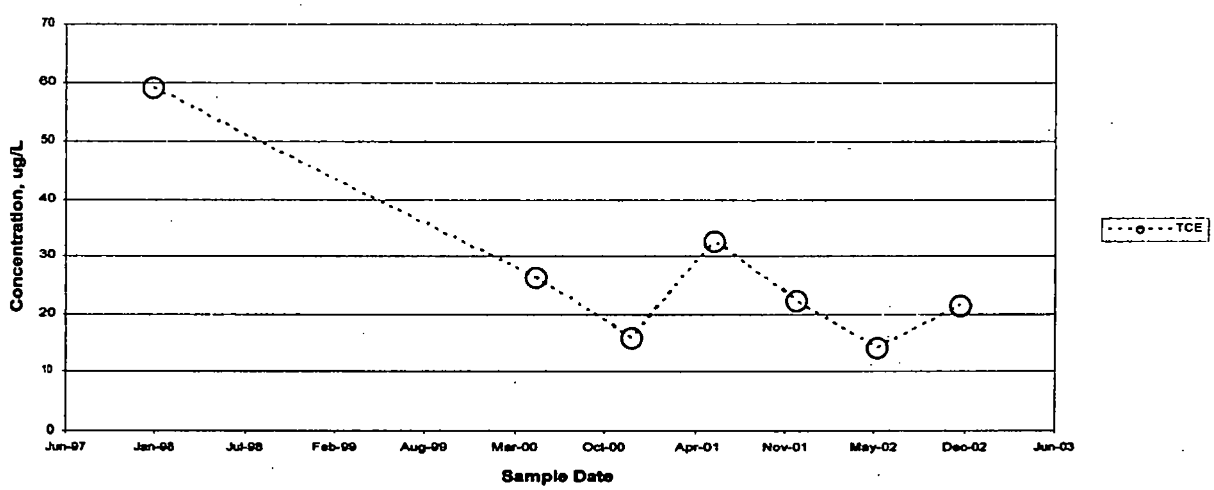
3. NewPiper Response :

A comprehensive plan will be submitted to EPA for a remedial action modification addressing monitoring inadequacies and proposed modifications including ,geochemical data collection, implementation detail, work element sequencing and time schedule estimate for task completion of the bioremediation pilot study,(BPS), plan. The current operational conditions will be taken into account with regard to groundwater chemistry in the areas of UVB well facilities.

To establish a foundation for a proposed BPS as well as to address areas where plume delineation is incomplete, a geoprobe/monitor well project would be proposed as the initial step to develop additional geologic information and groundwater sampling data. Interpretation of this resultant data would be used to select or confirm a BPS area as well as develop planning for bioremediation in other areas of the plume should the pilot program produce positive results. During these tasks, the UVB wells will be operational to the best of their capabilities and CVB well 15 will run at the normal schedule.

3.1 In the up-gradient area of contamination, UVB-1 never recovered significant concentrations of VOCs, as documented in the Five-Year Review Report, Table 1. This well was eventually replaced with UVB-1A in 2001. The Five-Year Review Report indicates that while UVB-1A has a design capacity of approximately 50 gallons per minute, it has been operating at 15 gallons per minute. The Five-Year Review Report does not include any documentation of the estimated area of influence of UVB-1A or its predecessor, the UVB-1 well. Thus, while the concentrations of contaminants in samples from monitoring wells near UVB-1A show dramatic decreases following startup of that well, it is not clear the extent of the area of this apparently effective ground water remedial action. Based on data from some of the monitoring wells in this up-gradient part of the Site (MW-4S in particular; see **Figure 1** below), there may not be much current effect of UVB-1A on part of the up-gradient contamination.

Figure 1. TCE Concentration Versus Time at MW-4S



3.1 NewPiper Response :

Well UVB-1A has a design capacity of 200 plus GPM; the aerator which processes the influent from UVB-1A has a design capacity of 50GPM. The UVB-1 well took two years of operation before the shallow screened pumping zone became clogged with iron precipitate and the deeper receptor zone experienced the same process. It proved unsuccessful to concentrate redevelopment efforts on the shallow screened interval because the pump intake set at 44 feet below the screen provided conditions that were ideal for screen encrustation.

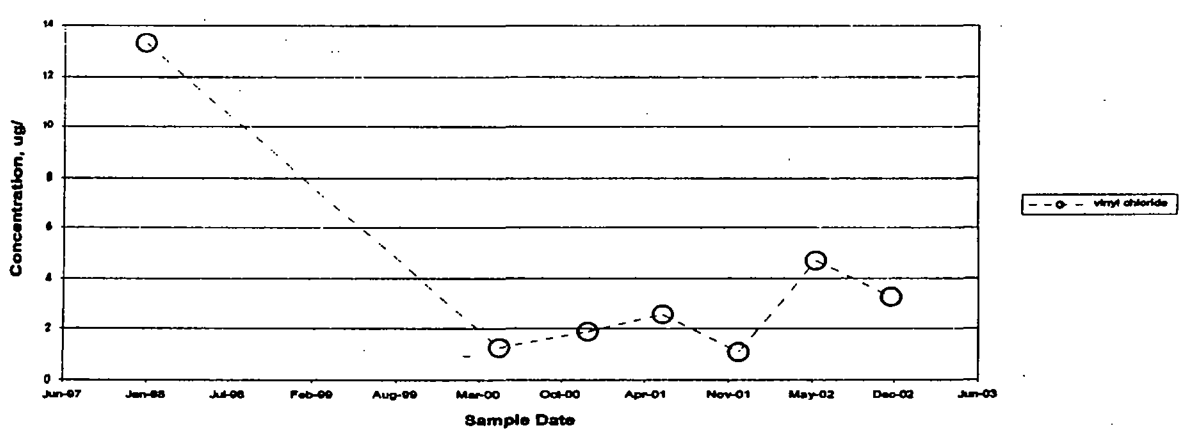
With the water-table averaging approximately 9 feet below land surface, and the screen setting of 12 to 21 feet below land surface, only three feet of available draw-down remains before the screen begins to dewater. A screen alternately wetted and exposed to the atmosphere encrusts very rapidly with a hard form of iron oxide whereas deeper constantly wetted screens at this site accumulate a softer red mud type which is easier to remove with air development. Fortunately, there has been no infestation with iron

bacteria in the UVB wells to date which involves colonial layering and festoons of bacterial growth.

The hot spot targeted by the screen setting in well UVB-1A contained cis-1,2 Dichloroethylene and Vinyl Chloride. Present isopleth data indicate these constituents have apparently been removed from the groundwater at least in the local depth zone intercepted by this screen interval. At a pumping rate of 10GPM, it may not be possible for shallow contaminants in the MW-4 area to be influenced and captured by the deeper UVB-1A screen because of miniscule head differential and layered, fine-grained aquitard stratigraphy.
Water table contouring from shallow and intermediate depth wells indicate a cone of influence probably no more than a few tens of feet in diameter. Also, with less than a foot of draw-down at this pumping rate in UVB-1A, and the MW-4 area being more aligned with the same groundwater contour, more than up-gradient from UVB-1A, flow lines would probably by-pass the cone of influence to the northeast.

3.2 Mid-plume monitoring wells appear to be poorly placed to track the progress of the remedial action. MW-16 is best located to monitor the progress of the remedial action, but data from that well are too variable over the period of UVB well operation to make any reasonable judgement about changes in water quality in the mid-plume area. MW-17 is another mid-plume well and data from that well suggest that the remedial action is having little or no effect on the concentration of vinyl chloride in that part of the plume (**Figure 2**).

Figure 2. Vinyl Chloride Concentrations Versus Time at MW-17



3.2 NewPiper Response :

The MW-17 well area, some distance north of the interpreted axis of plume occurrence contains only low level VC in the intermediate depth range. The area will be included in modified remediation planning with regard to geoprobe tasking and possibly deeper

screen placement to check on deeper spreading of contaminants primarily to the northeast.

3.3 The down-gradient part of the plume is supposedly being remediated by the UVB-2 well. As described in the Five-Year Review Report, this well has had problems with iron encrustation and has been operating at a pumping rate that is less than the design capacity. The capture zone for this well is not specified in the Five-Year Review Report but is potentially less than that needed for capture of all of the down-gradient plume. This conclusion is based on both the fact that the capture zone must be less than that anticipated when the remedy change to the UVB technology was proposed to EPA, and on the absence of a clear-cut trend of decreasing concentrations in many of the downgradient monitoring wells, and at the Vero Beach water-supply well #15.

3.3 NewPiper Response :

If in the sense of a classical plume characterization, the area near the center of the plume represents the maximum area of contaminant concentration, then UVB-2 is in the approximate correct location. It is true the cone of influence at pumping lower than design rates will encompass a small portion of the mapped plume. If the original design pumping rate could have been attained, despite not being able to create a circulation cell, more significant contamination could have been intercepted. In the remediation concept document of February 19, 1996, SBP Technologies, Inc., (UVB System consultants), recommended a second UVB Circulation cell in the vicinity of MW-19 monitor well. Subsequent discussion and planning led to one system in this area (UVB-2). The initial concept was to evaluate the success of the "circulation cell" technology at this site and if warranted the second UVB System would have been considered. With overlapping cones of influence, the systems may have intercepted a wider cross-section of the plume. In retrospect, since the "circulation cell" technology was unsuccessful due to site geology, a second or even a third system would have contributed little to overall plume capture, and would have increased the problem of disposal of treated effluent.

The various pumping rates over the past five years have varied from 5 to 35GPM. The present pumping rate of 20GPM has been maintained since April,2003. If water level data is collected just before the well pump cycles off, a cone of influence from deep well data maps a cone of influence of approximately 50feet in diameter. With CVB Well 15 on, the capture zone around UVB-2 is probably not much larger than observed cones of influence. Shallow and intermediate well data shows little to no disturbance of water level contours. As noted, the well processes some contaminants, but a minor portion of that which mixes with non-contaminated water within the capture zone of CVB-15, see Figure 20.

3.4 As previously noted, trends for wells in the down-gradient part of the plume have for the most part been undetectable, because of the extreme variability in concentrations over the period of record. There appears to be a large area of potential contamination in the down-gradient part of the plume that is not being effectively monitored by any of the existing monitoring wells. This comment is based on the fact that some low levels of contamination have been detected at MW-18, and this well is some 200 feet distant from MW-19. The concern arises regarding what contaminants may be present in the area between these two wells. Figure 2 in the Five-Year Review Report depicts the contaminant plume as terminating at the Vero Beach water-supply well #15 (i.e. any contamination migrating past UVB-2 is eventually captured by the water-supply well). The basis for this interpretation appears to be supposition, or a conceptual model, rather than being confirmed by actual water-quality or water-level monitoring data. Whether or not the Vero Beach Well #15 is the ultimate sink for contaminated ground water that bypasses the UVB wells, the apparent minimal concentration decreases at the water-supply well over the time since the 1992-1993 RI are an indication that the remedy is not successfully containing contamination and is probably inefficient in remediation at least some of the contamination at this Site. FDEP made this same comment.

3.4 NewPiper Response :

Isopleth interpretations in the area from MW 16 southeast through MW23 have indicated lower concentrations for cis-1,2 Dichloroethylene and Vinyl Chloride over the past five years however, compared to other plume areas, it remains the area of highest contaminant presence. In order to better understand plume configuration as an element in remediation modification planning, additional plume monitoring will be constructed on the south side of building 6.

Figure 21 illustrates modeling of CVB-Well #15 capture zone based upon a large-scale comprehensive pumping test conducted in 1997 and reported in submittals at that time. It is reasonable to conclude that CVB-Well #15 acts as a complete barrier to the movement of residual Vinyl Chloride past the well to the southeast. EPA groundwater quality testing in 1992 and 1993 as reported in EPA Superfund Update of January 1995, concluded that: "The canal is acting as a hydraulic barrier preventing the contaminants from migrating to the south side of the canal (eg., no VOC's were detected south of the canal").

4. Modifications to Monitoring the Remedial Action

Regardless of what remedial action is performed for the ground water contamination at the Piper Aircraft Site, modifications to the ground water monitoring program at the Site are needed. Specific areas of concern are the frequency and location of monitoring both water quality and water-level data.

4.1 Unless there is a clearly defined purpose for weekly water-level monitoring, then the frequency of water-level monitoring should be scaled back (data in Table 2). There is no indication in the Five-Year Review Report as to why this frequency of monitoring is needed or how these data are being evaluated.

4.1 NewPiper Response :

It is proposed that water level data collection be scaled back to quarterly events to coincide with the present quarterly report requirement. Other water level data collection events will be performed on an as needed basis for well performance and maintenance functions.

4.2 *Water Level Data.* The most important drawback with regard to water-level data presented in the Five-Year Review Report is that it is inadequate to allow for any understanding of either the capture zones for the UVB wells or the effects on the ground water flow from ground water recharge at the former extraction well and later, the recharge at UVB-1. This point is critical. For example, while the UVB wells may be remediating ground water in part of the area of contamination (albeit in a somewhat ineffective manner), there is some volume of contaminated ground water that may be bypassing both UVB wells or that is only slowly reaching those wells. Such problems or inefficiencies will delay the completion of the remedy and may result in unnecessary movement of the contaminant plume to the city's water-supply well #15. This point is considered further in the evaluation of ground water quality data for the Site.

Water-level data from the Site are presented in Table 2 of the Five-Year Review Report, and in various report figures (Appendix A figure) and in Figure 5 and Figure 6 at the back of the report. Relative to the issue of recovery of contaminated ground water by the UVB wells, the figure in Appendix A shows two cones of depression around the UVB wells (UVB-1A and UVB-2). The representation of water-level contours on this figure is probably fundamentally correct. However, there are a limited number of data points used to construct this figure (six measurements are plotted on the figure), which makes most of the figure a highly subjective interpretation.

4.2 NewPiper Response :

Because of the relatively low pumping rates of the influent withdrawal wells, significant precipitation events, regional well-field fluctuations, (scheduled maintenance and interference harmonics), "wet season-dry season" highs and lows, and contoured mounding, cones of influence can be undetectable to conservatively contoured with closure in the approximately 0.50 to 1.50 foot range. A number of times during the past five years, it was necessary to reduce pumpage as rapid rises in the water table brought receptor well water levels near tops of casings thereby drastically changing the extent of these features. Steady state conditions, implicit in any attempt to collect

meaningful data for quantitative interpretation, could not be maintained for long enough periods of time to predict the rate or volume of contaminant cleanup actually taking place.

At those times when mounding and cones of influence could be mapped as recognizable features, the best interpretations indicate diameters of closure for these features of between 50 and 100 ft. During the six week period between May and June2003, +well UVB-1A could be pumped at 40GPM. In July 2003, water level data mapping from shallow and intermediate depth monitor wells showed closure or a cone of influence of approximately 200ft. in diameter with a little more than 1.00ft. of drawdown in the pumping well. At this pumping rate, the screen section in well UVB-1 became rapidly plugged with soft iron precipitate necessitating a flow decrease to 10GPM which has been holding to this date of 12/12/03.

All interpreted data over the five year period demonstrates that the up-gradient UVB system which was designed to possibly reduce the time period for contaminant cleanup by removing significant contamination in the source area has effected some remedial benefit, but not in an amount sufficient to achieve the intended project goal.

The intent of well UVB-2 was to act as a barrier facility located along the plume longitudinal axis to prevent the bulk of contamination from reaching CVB Well #15. It has achieved some success in processing contaminants however, maximum closure contouring indicates a cone of influence 50 to 80ft. diameter.

Recognizing the remedy of pump and treat was demonstrating numerous constraints towards anticipated goals, approximately three years ago NewPiper staff began examining alternate technology which could increase the overall cleanup efficiency and be cost effective in reaching intended project goals. Plans towards this end are discussed in the Issues and Recommendations portion of this report.

4.3 The locations for continued ground water monitoring should be reassessed as a part of the evaluation of a modified remedial action to address contaminated ground water. Certain wells that are monitored semiannually are likely to either be unnecessary for future monitoring, or may be useful for less frequent monitoring, or for water-level monitoring only.

4.3 Agreed; the proposed changes will be presented in a planning report to be submitted during the first half of 2004.

4.4 *Upgradient Areas of Contamination* - Data from the wells near the former extraction well indicate that contaminant concentrations in that area have decreased to values less than the ROD-specified performance standards. This apparent condition would have to be confirmed by monitoring ground water in that area for some period after there had been no injection of water into the former extraction well. Such injection may have the effect of diluting low-level contamination, or otherwise altering the ground water flow and chemistry such that persistent low-level concentrations of the VOCs that would be present under ambient flow and chemistry conditions are missed.

Using MW-4S as the benchmark monitoring well for evaluating the progress of the remedial action in the vicinity of UVB-1, it appears that TCE concentrations have declined and then stabilized (or the rate of decline in concentration has become immeasurable. This condition suggests the need for modifications to the remedial action in this area, which would likely necessitate cessation of re-injection of treated ground water into UVB-1.

A third area of upgradient ground water contamination is at the location of UVB-1A, the replacement for UVB-1 that was put into operation in July 2001. MW-14S and MW-14 (an I depth well) are located in the vicinity of UVB-1A. Data from both of these wells show high contaminant concentrations (particularly vinyl chloride and cis 1,2-DCE) in the period prior to June 2001 and from June 2001 onward, much lower concentrations of these contaminants. These data suggest that ground water contamination in this particular "hot spot" has been almost completely removed, although vinyl chloride concentrations above the 1 ug/L Florida MCL may still be present.

It is unclear from data in the Five- Year Review Report if the operation of the UVB well is considered to be responsible for the substantial decrease in contaminant concentrations at the MW-14 well cluster.

4.4 NewPiper Response :

Groundwater monitoring needs to be continued in the event of Extraction well shutdown as it is characteristic of VOC cleanups to experience some return of low level contamination following a seemingly successful period of non-detects. Data from MW-4(S) and the surrounding local area shows a stubborn persistence of Trichloroethylene in the shallow zone of approximately 20 to 30ft. in depth. This is one area for a potential bioremediation pilot study. The flow of treated groundwater at an apparently stabilized pumping rate of 10GPM into the screen section from 57 to 66ft. below land surface registers as a closure of groundwater mounding of about 50 to 70 feet in diameter only in interpretations of intermediate and deep water level data. Shallow wells don't pick it up. It might be possible to keep the system going while a pilot study was under way. Increased monitor capability in this area preceding modified remedial activities could better define this local hydrology.

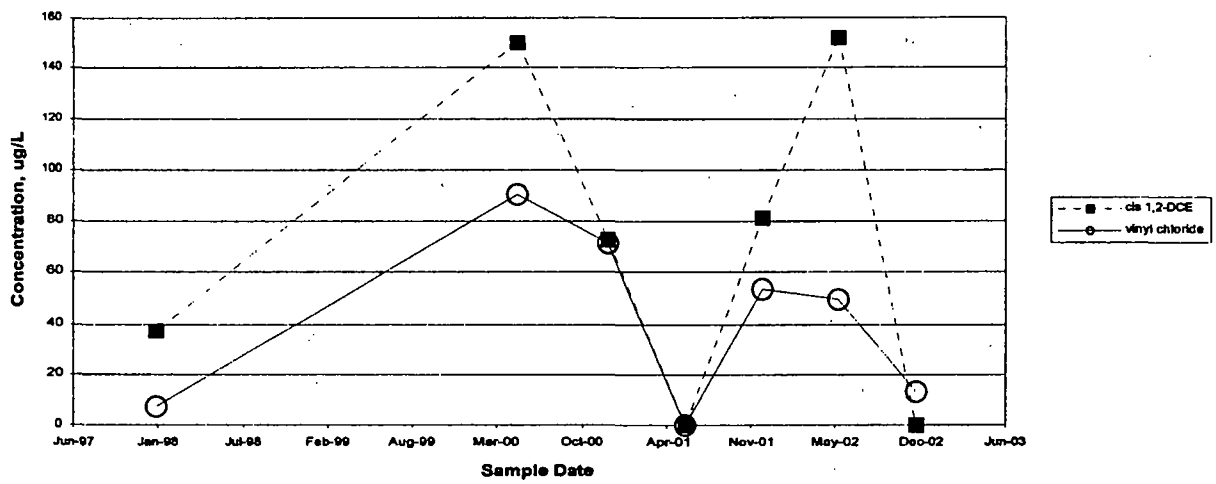
Well UVB-1A became operational in July,200L The first sampling event detected 16ppb Vinyl Chloride at a pumping rate of 40GPM. Concentrations have varied up and down at a third to one-half of this value at pumping rates between 6 and 35GPM, until June

2003, when the value went to 12ppb. At the time of the June sampling event, the well had been pumping 40GPM for several weeks. The available data seems to indicate a correlation between pumping rate and Vinyl Chloride concentration. Following the start up of UVB-1A, the noted hot spot had diminished significantly.

4.5 *Mid-Plume Area of Contamination* - The mid-plume area of contamination is considered as being the area that is between the area of UVB-1, UVB-1A and the former site extraction well and the area around UVB-2. There are three wells in this part of the Site: MW-15, MW-16 and MW-17. All three wells are identified as being in the intermediate depth range (30 to 60 feet). MW-17 is apparently not positioned near the centerline of contamination (area of highest concentrations in the mid-plume area). MW-16 appears to be in the general vicinity of the plume centerline. MW-15 is apparently at the extreme fringe of the plume (there has been one detection of cis 1,2-DCE at 0.99 ug/L in several samples from this well). MW-15 is not discussed further in this memorandum report. More importantly, **all the mid-plume wells are likely to be screened at depths above the area of highest contaminant concentrations**. Figure 8 in the Five-Year Review Report suggests this is the case. This comment was also noted by FDEP.

At MW-16, time-concentration data present an unclear picture of time concentration trends for vinyl chloride and cis 1,2-DCE. These are the two contaminants of concern that have been detected at that location in concentrations periodically exceeding their respective MCLs. **Figure 3** shows the MW-16 time-concentration data for cis 1,2-DCE and vinyl chloride. The pattern of highly variable concentrations suggests either different well sampling and purging procedures or slightly different flow patterns in the aquifer. Either condition may result in a sample representing either deeper, more contaminated ground water or shallower, less contaminated ground water (or ground water that is at times more representative of the plume centerline concentrations in this part of the plume).

Figure 3. MW-16 Concentration Trends



There is clearly a need for alternate monitoring locations or monitoring strategies in the mid-plume area. Neither MW-17 nor MW-16 appear to be properly placed to track the core of the contaminant plume in this area. MW-16 may be located in an area of steep concentration gradients, where minor changes in either flow direction or well purging and sampling procedures results in highly variable concentration changes between different sample events.

4.5 NewPiper Response :

A remedial modification plan will address the development of additional monitoring in the areas of MW-15,16,17 and 18. The focus of new subsurface data collection will be concentrated on deeper plume delineation.

4.6 *Downgradient Plume Area (Near UVB-2)* - The plume configuration in this downgradient area appears to be complex. At the MW-22 and MW-23 well pairs, the deeper of each well pair has generally shown lower contaminant concentrations than the shallower well. At MW-19, which is a deep well within a few tens of feet of the MW-22 and MW-23 well pairs, concentrations of cis 1,2-DCE and vinyl chloride have generally (from 1998 to 2002) been higher than at MW-22S or MW-23S. This difference may in part reflect a greater effect of the UVB well on MW-22S and MW-23S concentrations.

It is unknown if concentrations at a comparable shallower depth at the MW-19 location would be higher than the concentrations in MW-19 samples.

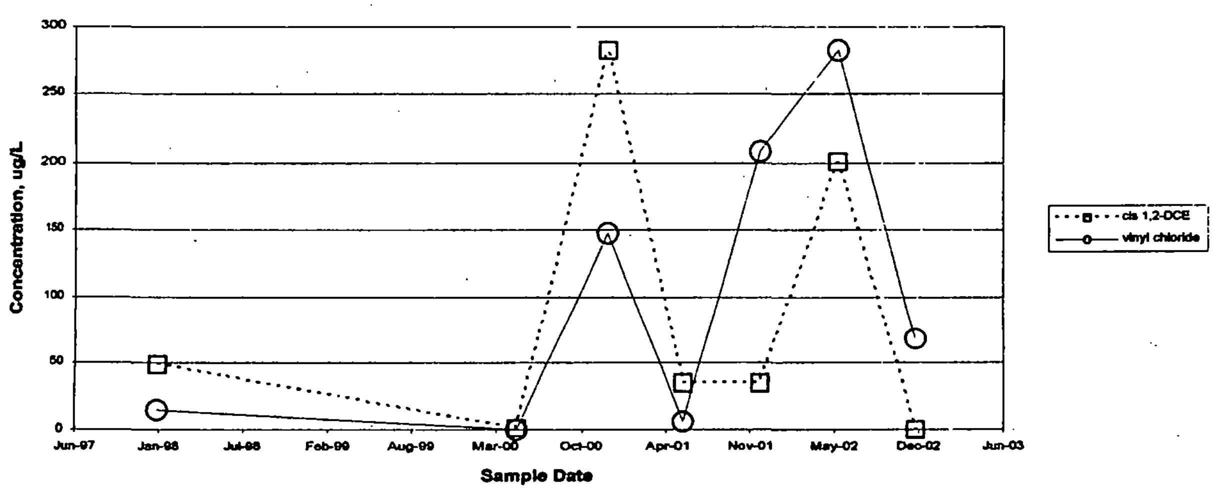
Concentration trends in the downgradient part of the plume are difficult to discern. At MW-23S there may be a trend of decreasing concentrations, while at MW-22S and MW-

19, concentrations between different sample periods have been highly variable, similar to what is observed at MW-16 in the mid-plume area. **Figure 4** shows time-concentration data for MW-19. This figure shows that for MW-19, no statement can be made about the progress of the ground water remedial action in the part of the downgradient part of the plume monitored by that well.

4.6 NewPiper Response :

Figure 15 isopleths show a decrease in cis,-1,2 DCE from 1997 through 2002 in the area of MW-19. Isopleths are somewhat misleading in that they depict a smooth transition and connected occurrence of contamination. The residual contaminants probably occur in a three-dimensional random arrangement of small lenses and blobs, the placement of which is controlled by an interplay of hydrologic, geologic and phase relationship variables. Looking for a progressive downward trend in certain wells can be unproductive. The ups and downs in residual concentration shown by various wells despite a rigorous attempt to keep all sampling protocols identical are attributed to the sporadic and intermittent release of contaminants to the down gradient water flow occurring in a fairly anisotropic aquifer.

Figure 4. MW-19 Concentration Trends



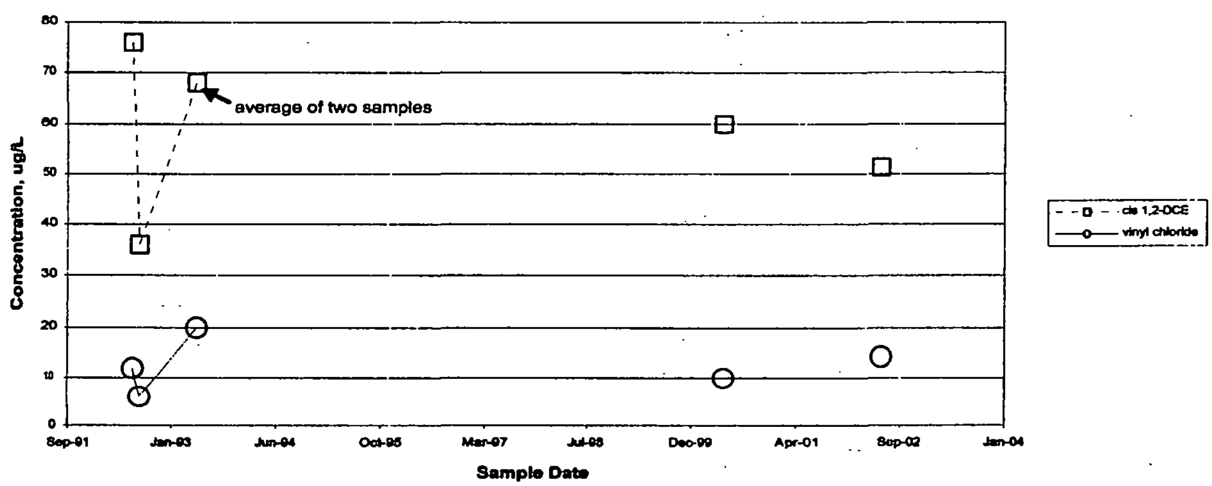
4.7 *City of Vero Beach Well (CW-15)* - Ground water quality data from the city well #15 are presented in Table 3 of the Five-Year Review Report. Only two samples from the well are included in the table (May 2000 and June 2002). The May 2000 sample contained 59.7 ug/L cis 1,2-DCE and 9.8 ug/L vinyl chloride. The June 2002 sample contained 51.2 ug/L cis 1,2-DCE and 14.3 ug/L vinyl chloride. This limited amount of data does not indicate that the ground water remedial action at the Piper Site is effectively reducing concentrations at the water-supply well. For further comparison, data from city well #15 that were obtained during the RI are also summarized in EPA's 1993 Record of Decision. These data indicated that in the 1992 to 1993 time period, cis 1,2-DCE was present at conentrations of between 36 and 76 ug/L, while vinyl chloride was present at concentrations in the range of 5.9 to 20 ug/L. **Figure 5** shows time-concentration data from Vero Beach well #15.

4.7 NewPiper Response :

The zones of UVB capture are small compared to the zone of capture for CVB #15 and comprise a minimal influence on residual contamination levels.

Agreed; NewPiper has been investigating alternative remedial technology to augment existing remedial methodology.

Figure 5. Vero Beach Well #15 Concentration Trends



The presence of continuing concentrations of vinyl chloride above its stated MCL and at concentrations comparable to those observed almost a decade earlier is an indication that the remedial action needs to be modified to better control movement of contaminated ground water beyond the more downgradient area of ground water remediation at the Site (the UVB-2 area). This comment was also made by FDEP.

5. Location of Monitoring Wells

The current monitoring program at the Piper Aircraft Site has several weaknesses that should be discussed in the Five-Year Review Report and addressed as a part of the modified ground water remedial action.

5.1 The limited amount of monitoring in the mid-plume area is inadequate to track the progress of the remedial action in this area, where the highest residual concentrations of site contaminants may currently be present. In particular, there are indications that some of the more highly contaminated ground water in the mid-plume area may be deeper than any of the monitoring wells that are in that area. This condition is indicated, for example, by Figure 8 in the Five-Year Review Report. Note that on this figure, the concentration contours in the vicinity of MW-16 but deeper in the aquifer are entirely speculative. It is entirely possible that given the periodic observance of vinyl chloride in the 50 to 60-ug/L range in MW-16 samples obtained in the last two years, vinyl chloride concentrations deeper in the aquifer could be on the order of those observed deeper in the aquifer at downgradient well MW-19 (potentially in excess of 200 ug/L). **Monitoring of the deeper ground water in the mid-plume area is recommended.** It would be advantageous at this Site to perform a screening analysis of contaminant concentrations at different depths in the aquifer (e.g. collect a series of vertical samples for on-site analysis using a direct-push drilling rig), to determine the best placement and screen length for any additional permanent monitoring wells. FDEP also noted this same recommendation.

5.1 NewPiper Response :

The remedial action modification plan will address areas for geoprobe and/or well construction activities.

5.2 In the downgradient plume area, there are two concerns. First, the plume configuration in the area around UVB-2 may not be fully understood, based on the depiction of the vinyl chloride contamination in the Five-Year Review Report Figure 8 cross section. This figure suggests there is a relatively concentrated part of the plume at a depth of roughly 20 to 30 feet, and a second area of relatively high concentrations (in at least a part of the plume) at a depth of roughly 60 feet. There needs to be some better confirmation of the vertical distribution of contaminants and the depth of the most significant contamination in this area. This information can then be used to establish the most appropriate locations and depths for monitoring the progress of further remedial actions in the mid-plume area.

As with the case for the mid-plume area, EPA recommends doing vertical contaminant profiling of discrete intervals to the base of the surficial aquifer in the downgradient area. This will allow for a better understanding of the current plume configuration in that area, so that the best locations and depths can be selected for long-term monitoring of further remedial actions. The MW-19 location is an obvious candidate for this type of vertical profiling, because there may be relatively significant contamination both shallower and deeper in the aquifer at that point that needs to be better understood. It would also be advantageous to investigate the vertical distribution of contaminants at some location that is between MW-19 and MW-18 to the west. While the Five-Year Review Report depicts the core of the plume as being in the vicinity of existing monitoring wells near UVB-2, there is a possibility of more significant contamination to the west-southwest of MW-19. Whether or not such contamination exists and whether or not it is being captured by Vero Beach well #15 is open to question. Finally, it would be worthwhile to perform vertical profiling analysis around UVB-2. While there are monitoring wells at multiple depths at this location, there is a potential that these wells are not appropriately constructed to detect the highest contaminant concentrations in that area.

*5.2 **NewPiper Response :***

See 5.1 above.

5.3 One final point concerning monitoring locations relates to water-level monitoring. While the water-level monitoring frequency at the Site appears to be excessive, as note above, there needs to be greater spatial coverage of the water-level monitoring, to better establish ground water flow directions and capture zones for extraction wells.

In particular, the question arises as to whether or not all of the ground water contamination at the Site has been (or will be) treated by whatever remedial action is operative, and whether or not the ultimate sink for ground water exiting the Site is actually the Vero Beach #15 water-supply well. Specific wells for monitoring are not suggested in this memorandum report, but the water-level monitoring network must be sufficient to establish that (1) any remedial action is affecting all of the contamination that would otherwise migrate outside the Piper property and (2) that any residual ground water contamination that has already migrated outside of the Piper property will be captured by the Vero Beach water-supply well #15.

*5.3 **NewPiper Response :***

It is proposed in the Recommendations section of this report that water level data collection be modified from weekly to monthly and also to continue the present practice of recording water levels as near peak dates of end of dry and rainy seasons as possible.

Figures 20 and 21 have been added to the Five Year Review Report to represent the best existing interpretation of the CVB Well 15 capture zone in the form of flow net modeling from data collected during pumping tests of CVB Well 15 with data collection from existing and former pumping test monitoring wells. These data were originally

reported in Appendix K of the Supplemental Investigation And Focused Feasibility Study For Preliminary Remedial Design , March 20, 1997.

These figures demonstrate that CVB Well 15 is capturing any residual contamination which has migrated off NPA property. Because of the overriding project problems of lack of cooperating geology and resultant hydrology negating the "circulation cell " development, and the disposing of large volumes of treated effluent, pump and treat facilities, UVB Wells 1&2 contribute a smaller percentage of residual contaminant cleanup than originally hypothecated.

It is interpreted that the present network of shallow and intermediate zone monitor wells is sufficient to develop accurate water table contours , however, the deep zone contouring is presently interpreted from fewer data points. A better distribution of data collection points for the deep zone will be presented in the forthcoming Remedial Modification submittal during the first half of 2004.

If you have any questions or comments, please call me at 404-562-8920. Thank you again for your submittal of the report.

Sincerely,

Jamey Watt
Remedial Project Manager

cc: Kelsey Helton, FDEP
site file

TABLES

TABLE 1

UVB WELL SUMMARY OF ANALYTICAL DATA

Date	Parameter (ug/L)	UVB-1A Influent	UVB-1 Effluent	UVB-2 Influent	UVB-2 Effluent
1st Qtr 2003	1,1-Dichloroethylene	<1	<1	<1	<1
	cis-1,2-Dichloroethylene	6.50	<1	72.90	<1
	Trichloroethylene	<1	<1	<1	<1
	Vinyl Chloride	5.00	<1	100.00	<1
2nd Qtr 2003	1,1-Dichloroethylene	<1	<1	<1	<1
	cis-1,2-Dichloroethylene	45.40	<1	53.20	<1
	Trichloroethylene	<1	<1	<1	<1
	Vinyl Chloride	12.30	<1	51.70	<1
3rd Qtr 2003	1,1 Dichloroethylene	<1	<1	<1	<1
	cis-1,2-Dichloroethylene	42.70	<1	30.20	<1
	Trichloroethylene	<1	<1	<1	<1
	Vinyl Chloride	13.50	<1	40.60	<1
4th Qtr 2003	1,1 Dichloretyhylene	<1	<1	<1	<1
	cis-1,2-Dichloroethylene	53.40	<1	32.90	<1
	Trichloroethylene	<1	<1	<1	<1
	Vinyl Chloride	34.90	<1	24.80	<1

** Probable residual water in sump from aerator cleaning event.

TABLE 1

UVB WELL SUMMARY OF ANALYTICAL DATA

Date	Parameter (ug/L)	UVB-1,1A Influent	UVB-1 Effluent	UVB-2 Influent	UVB-2 Effluent
1st Qtr 2001	1,1-Dichloroethylene	<1	<1	<1	<1
	cis-1,2-Dichloroethylene	<1	<1	66.80	<1
	Trichloroethylene	<1	<1	<1	<1
	Vinyl Chloride	<1	<1	57.10	<1
2nd Qtr 2001	1,1-Dichloroethylene	<1	<1	<1	<1
	cis-1,2-Dichloroethylene	<1	<1	74.30	<1
	Trichloroethylene	<1	<1	<1	<1
	Vinyl Chloride	<1	<1	42.40	<1
3rd Qtr 2001	1,1 Dichloroethylene	<1	<1	System	Inoperative
	cis-1,2-Dichloroethylene		<1	"	"
	Trichloroethylene	<1	<1	"	"
	Vinyl Chloride	<1	<1	"	"
4th Qtr 2001	1,1 Dichloretyhylene	<1	<1	<1	<1
	cis-1,2-Dichloroethylene	<1	<1	111.00	<1
	Trichloroethylene	<1	<1	<1	<1
	Vinyl Chloride	1.90	<1	59.20	<1
	** Probable residual water in sump from aerator cleaning event.				
1st Qtr 2002	1,1-Dichloroethylene	<1	<1	<1	<1
	cis-1,2-Dichloroethylene	11.00	<1	149.00	<1
	Trichloroethylene	<1	<1	<1	<1
	Vinyl Chloride	10.00	<1	77.70	<1
2nd Qtr 2002	1,1-Dichloroethylene	<1	<1	System	Inoperative
	cis-1,2-Dichloroethylene	8.30	<1	"	"
	Trichloroethylene	<1	<1	"	"
	Vinyl Chloride	9.90	<1	"	"
3rd Qtr 2002	1,1 Dichloroethylene	<1	<1	1.10	<1
	cis-1,2-Dichloroethylene	7.60	<1	131.00	<1
	Trichloroethylene	<1	<1	<1	<1
	Vinyl Chloride	10.10	<1	104.00	<1
4th Qtr 2002	1,1 Dichloretyhylene	<1	<1	<1	<1
	cis-1,2-Dichloroethylene	<1	<1	72.60	<1
	Trichloroethylene	<1	<1	<1	<1
	Vinyl Chloride	9.90	<1	95.40	<1
	** Probable residual water in sump from aerator cleaning event.				

TABLE 1

UVB WELL SUMMARY OF ANALYTICAL DATA

Date	Parameter (ug/L)	UVB-1 Influent	UVB-1 Effluent	UVB-2 Influent	UVB-2 Effluent
Sep-98	1,1-Dichloroethylene	<2	<2	<2	<2
	cis-1,2-Dichloroethylene	2.40	<2	<2	<2
	Trichloroethylene	1.40	<2	<2	<2
	Vinyl Chloride	<1	<1	<1	<1
1st Qtr. 1999	1,1-Dichloroethylene	<2	<2	<2	<2
	cis-1,2-Dichloroethylene	3.30	<2	15.50	<2
	Trichloroethylene	2.30	<2	<2	<2
	Vinyl Chloride	<1	<1	17.40	<1
2nd Qtr. 1999	1,1-Dichloroethylene	<2	<2	<2	<2
	cis-1,2-Dichloroethylene	<2	<2	16.80	<2
	Trichloroethylene	<2	<2	<2	<2
	Vinyl Chloride	<1	<1	19.20	<1
3rd/4th Qtr. 99	1,1-Dichloroethylene	<1	<1	<1	<1
	cis-1,2-Dichloroethylene	<1	<1	12.40	6.4 **
	Trichloroethylene	<1	<1	<1	<1
	Vinyl Chloride	<1	<1	13.60	7.0 **
	** Probable residual water in sump from aerator cleaning event.				
1st Qtr. 2000	1,1-Dichloroethylene	<1	<1	<1	<1
	cis-1,2-Dichloroethylene	<1	<1	9.80	<1
	Trichloroethylene	<1	<1	<1	<1
	Vinyl Chloride	<1	<1	14.31	<1
2nd Qtr. 2000	1,1-Dichloroethylene	<1	<1	<1	<1
	cis-1,2-Dichloroethylene	<1	<1	10.60	<1
	Trichloroethylene	<1	<1	<1	<1
	Vinyl Chloride	<1	<1	6.60	<1
3rd Qtr. 2000	1,1 Dichloroethylene	<1	<1	System	Inoperative
	cis-1,2-Dichloroethylene	2.10	<1	"	"
	Trichloroethylene	<1	<1	"	"
	Vinyl Chloride	<1	<1	"	"
4th Qtr. 2000	1,1 Dichloretyhylene	<1	<1	<1	<1
	cis-1,2-Dichloroethylene	<1	<1	66.80	10.80**
	Trichloroethylene	<1	<1	<1	<1
	Vinyl Chloride	<1	<1	57.10	6.00**
	** Probable residual water in sump from aerator cleaning event.				

TABLE 2

DEPTH TO WATER MEASUREMENTS (SELECTED WELLS)

(Depth in Feet T.O.C.)

Third Quarter 2003

Date	MW-4I	MW-4D	MW-4S	MW-6S	MW-6D	MW-7	MW-22S	MW-22D	MW-23D	MW-23S	MW-23I1	MW-23I2
07/03/03	8.70	8.55	8.93	8.66	8.80	8.25	10.71	11.12	11.62	11.20	11.71	11.85
07/11/03	9.05	9.12	9.11	8.99	9.22	8.56	11.08	11.71	12.48	11.62	12.12	12.24
07/18/03	9.25	9.35	9.40	9.15	9.43	8.85	11.08	11.53	12.15	11.59	12.10	12.23
07/25/03	9.41	9.62	9.60	9.31	9.62	9.09	11.16	11.67	12.22	11.65	12.15	12.34
08/01/03	9.66	9.71	9.77	9.60	9.75	9.35	11.37	11.76	12.30	11.73	12.28	12.42
08/08/03	9.16	9.15	9.55	9.10	9.25	8.74	10.77	11.33	11.58	11.20	11.72	11.90
08/15/03	8.86	8.93	9.10	8.64	8.85	7.78	10.23	10.75	11.13	10.70	11.25	11.37
08/22/03	8.34	8.50	8.66	8.20	8.30	7.87	9.20	9.15	9.76	9.57	9.99	10.10
08/29/03	7.97	8.13	8.23	7.82	7.95	7.81	8.30	8.40	8.40	8.50	9.02	9.03
09/06/03	7.88	7.95	7.63	7.85	7.97	7.65	9.22	9.71	10.04	9.65	10.18	10.27
09/15/03	8.20	8.44	8.43	8.18	8.45	7.98	10.02	10.56	11.00	10.52	11.04	11.22
09/19/03	8.57	8.67	8.65	8.48	8.70	8.16	10.15	10.53	11.00	10.46	11.10	11.27
09/26/03	8.22	8.31	8.40	8.25	8.40	7.82	10.03	10.41	10.51	10.33	10.67	11.11

TABLE 2

DEPTH TO WATER MEASUREMENTS (SELECTED WELLS)

(Depth in Feet T.O.C.)

Second Quarter 2003

Date	MW-4I	MW-4D	MW-4S	MW-6S	MW-6D	MW-7	MW-22S	MW-22D	MW-23D	MW-23S	MW-23I1	MW-23I2
04/05/03	10.95	11.12	11.04	11.00	11.26	10.14	13.38	14.21	14.42	13.79	14.39	14.57
04/12/03	11.08	11.15	11.12	11.04	11.30	10.22	13.46	14.09	14.27	13.84	13.35	14.60
04/18/03	11.14	11.31	11.26	11.15	11.42	10.26	13.47	14.18	14.54	14.00	14.50	14.67
04/25/03	11.24	11.46	11.30	11.24	11.55	10.31	13.48	14.21	14.76	14.10	14.62	14.78
05/02/03	10.69	10.86	10.98	10.69	10.98	9.98	12.60	13.09	13.60	13.11	13.60	13.70
05/09/03	10.85	11.07	10.73	10.83	10.93	9.98	12.83	13.42	14.02	13.34	13.87	14.02
06/16/03	10.40	10.54	10.75	10.28	10.47	10.25	11.07	11.00	11.27	11.37	11.80	11.81
05/23/03	10.41	10.24	10.05	10.22	10.57	10.09	11.75	12.17	12.65	12.11	12.67	12.30
06/02/03	10.55	10.57	10.65	10.38	10.64	9.95	12.07	12.55	12.65	12.51	12.92	13.15
06/06/03	10.15	10.30	10.53	10.10	10.11	10.13	12.83	12.30	12.63	12.23	12.73	12.96
06/13/03	9.65	9.44	10.11	9.42	9.55	9.75	11.39	11.83	12.26	11.93	11.42	12.63
06/24/03	8.83	8.65	9.46	8.74	8.87	9.05	10.00	9.90	10.22	10.43	10.93	10.98
6/30/2003	8.49	8.20	9.03	8.43	8.45	8.15	9.96	10.08	10.40	10.25	10.78	10.81

TABLE 2

DEPTH TO WATER MEASUREMENTS (SELECTED WELLS)

(Depth In Feet T.O.C.)

First Quarter 2003

Date	MW-4I	MW-4D	MW-4S	MW-6S	MW-6D	MW-7	MW-22S	MW-22D	MW-23D	MW-23S	MW-23I1	MW-23I2
01/06/03	8.87	9.02	9.15	8.71	9.06	8.26	10.72	11.28	11.65	11.18	11.75	11.92
01/17/03	9.00	9.25	9.18	8.98	9.28	8.50	10.97	11.45	12.17	11.38	11.98	11.90
01/24/03	9.34	9.52	9.48	9.41	9.53	8.81	11.28	11.67	12.42	11.59	12.22	12.46
01/31/03	9.65	9.74	9.69	9.62	9.71	9.10	11.64	11.94	12.73	11.81	12.39	12.58
02/07/03	10.28	10.34	10.01	9.77	10.02	9.46	11.81	12.23	13.05	12.09	12.61	12.73
02/14/03	10.41	10.44	10.11	9.92	10.31	9.55	12.30	12.62	13.29	12.41	12.92	13.21
02/21/03	10.48	10.62	10.19	10.31	10.54	9.71	12.57	13.10	13.58	12.88	13.40	13.54
02/28/03	10.55	10.75	10.26	10.53	10.83	9.80	12.78	13.05	13.93	13.37	13.87	14.12
03/07/03	10.73	10.94	10.68	10.71	11.04	9.94	13.08	13.51	13.32	13.50	14.01	14.29
03/14/03	10.92	11.12	11.03	10.90	11.21	10.15	13.20	13.54	14.61	13.83	14.33	14.44
03/21/03	10.90	11.09	11.00	10.87	11.20	10.11	13.27	13.78	14.63	13.86	14.00	14.49
03/28/03	10.91	11.07	10.97	10.91	11.21	10.07	13.33	13.83	14.65	13.85	14.95	14.53

TABLE 2

DEPTH TO WATER MEASUREMENTS (SELECTED WELLS)

(Depth In Feet T.O.C.)

Fourth Quarter 2002

Date	MW-4I	MW-4D	MW-4S	MW-6S	MW-6D	MW-7	MW-22S	MW-22D	MW-23D	MW-23S	MW-23I1	MW-23I2
10/04/02	8.10	8.30	8.18	8.11	8.38	7.58	10.10	11.13	11.30	10.60	11.05	11.24
10/14/02	8.58	8.76	8.30	8.50	8.75	7.88	10.68	11.25	11.77	11.15	11.69	11.70
10/18/02	8.76	9.03	8.75	8.75	9.05	8.13	11.04	11.72	12.31	11.63	12.10	12.28
10/25/02	9.13	9.35	9.12	9.05	9.34	8.22	11.28	11.96	12.60	11.81	12.43	12.59
11/02/02	9.42	9.65	9.43	9.37	9.65	8.71	11.45	12.15	12.79	12.05	12.59	12.79
11/08/02	9.75	9.95	9.72	9.68	9.95	9.02	11.94	12.65	13.06	12.49	13.05	13.21
11/15/02	9.92	9.94	9.88	9.88	10.23	9.28	12.16	12.77	13.55	12.75	13.17	13.32
11/29/02	10.10	10.17	10.25	9.98	10.15	9.63	11.32	11.22	11.47	11.74	12.25	12.15
12/06/02	10.18	10.39	10.10	10.13	10.38	9.64	11.90	12.59	12.93	12.42	12.90	13.04
12/13/02	9.46	9.53	9.80	9.40	8.95	8.85	10.70	10.58	10.90	11.05	11.52	11.55
12/20/02	9.28	9.45	9.48	9.22	9.49	8.63	11.03	11.56	11.98	11.52	12.13	12.28

TABLE 2

DEPTH TO WATER MEASUREMENTS (SELECTED WELLS)

(Depth In Feet T.O.C.)

Third Quarter 2002

Date	MW-4I	MW-4D	MW-4S	MW-6S	MW-6D	MW-7	MW-22S	MW-22D	MW-23D	MW-23S	MW-23I1	MW-23I2
7/19/2002	6.46	6.61	6.50	6.35	6.69	5.99	8.04	8.53	9.00	8.49	9.03	9.11
7/29/2002	6.60	6.65	6.60	6.47	6.80	5.87	8.40	8.93	9.42	8.90	9.44	9.58
8/2/2002	6.20	6.90	6.80	6.61	6.90	6.17	8.62	9.13	9.64	9.11	9.68	9.82
8/9/2002	6.60	6.21	6.74	6.71	6.95	5.50	8.76	9.72	10.55	9.40	9.90	10.15
8/16/2002	6.12	6.29	6.28	6.05	6.33	5.13	8.03	8.86	9.69	8.62	9.10	9.43
8/23/2002	6.63	6.81	6.62	6.60	6.80	6.03	8.65	9.35	9.95	9.16	9.73	9.85
8/30/2002	6.10	6.28	6.30	5.95	6.05	5.87	6.67	6.82	7.18	6.93	7.43	7.45
9/6/2002	6.90	7.14	6.85	6.80	7.11	6.41	8.85	9.53	10.13	9.38	9.82	10.00
9/17/2002	7.56	7.72	7.41	7.46	7.80	6.87	9.74	10.41	10.94	10.23	10.80	11.00
9/27/2002	8.09	8.24	8.00	8.05	8.29	7.37	10.31	10.94	11.62	10.93	11.43	11.63

TABLE 2

DEPTH TO WATER MEASUREMENTS (SELECTED WELLS)

(Depth In Feet T.O.C.)

Second Quarter 2002

Date	MW-4I	MW-4D	MW-4S	MW-6S	MW-6D	MW-7	MW-22S	MW-22D	MW-23D	MW-23S	MW-23I1	MW-23I2
4/5/2002	9.45	9.11	9.02	9.34	9.75	8.79	11.83	12.90	13.38	12.36	13.03	13.21
4/12/2002	9.90	10.09	9.76	9.88	10.18	9.20	12.10	12.63	13.13	12.57	13.08	13.27
4/20/2002	9.68	9.85	9.35	9.57	9.79	9.26	10.98	11.53	11.95	11.37	11.86	12.01
4/26/2002	9.95	10.14	9.86	9.84	10.08	9.51	9.80	12.20	12.67	11.87	12.48	12.06
5/3/2002	10.40	10.60	10.00	10.34	10.41	9.80	12.32	12.86	13.42	12.80	13.25	13.12
5/10/2002	10.70	10.97	10.60	10.64	10.59	10.20	12.48	12.95	13.43	12.97	13.46	13.58
5/17/2002	10.83	10.78	10.65	11.0810.8	10.37	10.37	12.50	13.00	13.32	13.00	13.47	13.42
5/20/2002	10.80	10.96	10.33	10.87	10.72	10.11	12.62	13.49	14.17	13.17	13.69	13.93
5/24/2002	10.80	11.02	10.73	10.83	11.09	9.96	12.83	13.93	14.71	13.44	14.03	14.29
5/31/2002	10.63	10.80	10.80	10.55	10.77	9.94	11.78	12.08	12.73	12.20	12.73	12.97
6/10/2002	9.80	9.94	10.14	9.63	9.80	9.85	9.80	10.02	10.02	10.08	10.53	10.57

TABLE 2

DEPTH TO WATER MEASUREMENTS (SELECTED WELLS)

(Depth In Feet T.O.C.)

First Quarter 2002

Date	MW-4I	MW-4D	MW-4S	MW-6S	MW-6D	MW-7	MW-22S	MW-22D	MW-23D	MW-23S	MW-23I1	MW-23I2
1/11/2002	7.34	7.52	7.45	7.21	7.44	7.05	8.05	8.72	8.35	8.38	8.94	8.50
1/18/2002	7.35	7.54	7.44	7.25	7.47	7.02	8.05	8.70	9.38	8.34	8.90	9.11
1/25/2002	7.65	7.86	7.63	7.42	7.64	7.74	7.88	8.38	8.57	0.07	8.50	8.50
2/2/2002	7.81	7.89	7.68	7.64	7.81	7.69	8.05	8.71	8.90	8.28	8.41	8.46
2/9/2002	7.99	8.10	7.81	7.80	7.93	7.73	8.42	9.05	9.30	8.47	8.65	8.72
2/12/2002	8.15	8.25	8.16	8.07	8.42	7.70	9.91	11.10	11.40	10.44	11.02	11.44
2/15/2002	8.05	8.25	7.98	8.02	8.28	7.41	9.80	10.90	11.56	10.32	10.91	11.12
2/22/2002	7.84	8.00	8.00	7.76	7.93	7.49	8.55	8.86	9.82	8.88	9.45	9.56
3/1/2002	7.71	7.84	7.83	7.51	7.74	7.37	8.37	8.58	9.77	8.49	8.91	9.27
3/8/2002	7.54	7.65	7.61	7.36	7.58	7.22	8.00	8.29	8.68	8.16	8.74	8.80
3/15/2002	7.72	7.88	7.67	7.35	7.45	7.50	8.20	8.59	9.20	8.47	8.98	9.10
3/25/2002	8.60	8.86	8.38	8.55	8.88	8.09	10.30	11.45	11.83	10.88	11.47	11.83
3/29/2002	8.90	8.81	8.84	8.91	8.98	8.37	11.33	11.83	12.87	11.72	12.45	12.39

TABLE 2

DEPTH TO WATER MEASUREMENTS (SELECTED WELLS)

(Depth In Feet T.O.C.)

Fourth Quarter 2001

Date	MW-4I	MW-4D	MW-4S	MW-6S	MW-6D	MW-7	MW-22S	MW-22D	MW-23D	MW-23S	MW-23I1	MW-23I2
9/28/2001	7.40	7.72	7.55	7.52	7.71	7.05	9.91	9.82	10.01	10.02	10.11	10.59
10/5/2001	7.86	8.07	7.79	7.81	8.10	7.27	9.94	10.51	11.02	10.46	11.00	11.04
########	8.22	8.45	8.24	8.15	8.52	7.57	10.43	10.98	11.52	10.91	11.47	11.61
########	7.65	7.70	7.02	7.53	7.70	7.29	8.38	8.23	8.55	8.67	8.46	9.16
########	7.10	7.25	6.91	6.95	7.38	6.96	7.18	7.51	7.74	7.81	8.43	8.57
11/2/2001	6.59	6.77	6.85	6.41	6.55	6.54	6.69	6.82	6.92	6.94	7.40	7.48
11/9/2001	6.52	6.65	6.71	6.28	6.41	6.55	6.71	6.83	7.00	6.98	7.47	7.63
########	6.18	6.19	6.57	6.13	6.35	5.59	7.25	8.13	8.86	7.63	8.20	8.34
########	6.63	6.83	6.74	6.45	6.65	6.44	7.03	7.22	7.38	7.29	7.75	7.90
########	6.47	6.54	6.59	6.37	6.56	5.94	7.57	8.52	9.37	7.96	8.54	8.76
12/3/2001	6.66	6.94	6.92	6.63	6.91	6.18	7.84	8.81	9.65	8.22	8.80	8.98
########	6.93	7.13	6.87	6.81	6.99	6.77	7.94	8.88	9.72	8.29	8.90	9.00

TABLE 2

DEPTH TO WATER MEASUREMENTS (SELECTED WELLS)

(Depth In Feet T.O.C.)

Third Quarter 2001

Date	MW-4I	MW-4D	MW-4S	MW-6S	MW-6D	MW-7	MW-22S	MW-22D	MW-23D	MW-23S	MW-23I1	MW-23I2
6/22/2001	9.85	9.65	9.52	9.23	9.40	9.67	9.20	9.30	9.46	9.40	9.90	9.90
6/29/2001	9.23	9.43	9.35	9.04	9.23	9.45	9.09	9.16	9.31	9.24	9.79	9.74
7/6/2001	9.10	9.22	9.15	8.81	8.98	9.27	8.81	8.90	9.15	9.10	9.58	9.60
7/13/2001	8.19	8.28	8.55	7.94	8.10	8.12	7.72	7.76	7.98	7.90	8.71	8.86
7/20/2001	7.94	7.72	8.24	7.62	7.81	8.02	7.58	7.61	7.81	7.78	8.29	8.48
7/27/2001	7.51	7.31	7.86	7.25	7.30	7.85	7.34	7.45	7.66	7.57	8.08	7.90
8/3/2001	7.50	7.51	7.72	7.37	7.48	7.34	8.22	8.92	9.32	8.62	9.23	7.80
8/10/2001	7.48	7.60	7.70	7.34	7.45	7.36	7,82	7.75	7.97	8.10	8.53	8.57
8/17/2001	7.38	7.55	7.50	7.18	7.34	7.50	7.43	7.51	7.71	7.65	8.15	8.16
8/24/2001	7.11	7.30	7.26	6.91	7.00	7.12	7.00	7.10	7.30	7.29	7.76	7.95
8/31/2001	7.20	7.31	7.32	6.94	7.10	7.19	7.06	7.15	7.33	7.32	7.83	8.02
9/13/2001	6.71	6.80	6.95	6.66	6.65	8.12	8.78	9.22	8.59	9.13	9.33	8.59
9/21/2001	7.21	7.45	7.20	7.13	7.40	6.75	9.88	9.45	9.98	9.40	0.91	10.08

TABLE 2

DEPTH TO WATER MEASUREMENTS (SELECTED WELLS)

(Depth In Feet T.O.C.)

Second Quarter 2001

Date	MW-4I	MW-4D	MW-4S	MW-6S	MW-6D	MW-7	MW-22S	MW-22D	MW-23D	MW-23S	MW-23I1	MW-23I2
4/6/2001	9.00	9.07	9.03	8.70	8.87	9.03	8.73	8.82	9.01	9.00	9.47	9.51
4/13/2001	9.02	9.29	9.21	8.83	8.90	8.64	8.83	8.87	9.25	9.12	9.61	9.59
4/20/2001	9.05	9.48	9.31	8.97	9.10	9.01	8.97	9.11	9.34	9.26	9.75	9.75
4/27/2001	9.43	9.80	9.50	8.95	9.00	9.63	9.09	9.16	9.40	9.36	9.82	9.86
5/4/2001	9.16	9.13	9.19	8.85	8.90	9.29	8.82	8.90	9.15	9.07	9.50	9.60
5/11/2001	8.94	8.98	9.13	8.70	8.80	9.29	8.82	8.90	9.15	9.07	9.50	9.60
5/18/2001	9.46	9.51	9.37	8.92	9.05	9.41	9.05	9.10	9.31	9.30	9.71	9.70
5/25/2001	9.50	9.61	9.50	9.20	9.35	9.66	9.14	9.23	9.46	9.44	9.80	9.80
6/1/2001	9.47	9.58	9.17	9.13	9.32	9.51	9.08	9.17	9.37	9.36	9.73	9.74
6/8/2001	9.33	9.44	8.92	9.07	9.30	9.44	8.96	9.07	9.25	9.22	9.61	9.71
6/15/2001	9.21	9.29	8.71	9.00	9.15	9.35	8.88	8.98	9.15	9.10	9.55	9.57
6/22/2001	9.45	9.65	9.52	9.23	9.40	9.67	9.20	9.30	9.46	9.40	9.90	9.90
6/29/2001	9.23	9.43	9.35	9.04	9.23	9.45	9.09	9.16	9.31	9.24	9.79	9.74

TABLE 2

DEPTH TO WATER MEASUREMENTS (SELECTED WELLS)

(Depth in Feet T.O.C.)

First Quarter 2001

Date	MW-4I	MW-4D	MW-4S	MW-6S	MW-6D	MW-7	MW-22S	MW-22D	MW-23D	MW-23S	MW-23I1	MW-23I2
01/03/01	8.24	8.43	8.30	8.03	8.13	8.13	8.75	8.75	8.95	9.06	9.50	9.45
01/11/01	8.68	9.00	8.66	8.42	8.69	8.57	8.67	8.73	8.94	8.93	9.42	9.40
01/19/01	8.56	8.90	8.60	8.38	8.43	8.27	8.90	9.33	9.88	9.15	9.68	9.78
01/26/01	8.50	8.67	8.64	8.44	8.62	8.00	9.37	10.39	11.25	9.70	10.21	10.44
02/05/01	8.76	8.97	8.88	8.64	8.90	8.35	9.45	10.41	11.34	9.66	10.32	10.56
02/09/01	8.75	8.94	8.85	8.57	8.88	8.28	9.48	10.48	11.33	9.77	10.32	10.58
02/16/01	8.90	9.13	9.03	8.84	9.05	8.57	9.72	10.58	11.49	10.01	10.56	10.76
02/26/01	8.72	9.26	9.04	8.82	9.00	8.70	9.64	10.53	11.42	9.93	10.41	10.64
03/02/01	8.53	8.38	9.05	8.82	8.91	8.74	9.57	10.48	11.37	9.80	10.28	10.51
03/09/01	9.22	9.38	9.38	8.95	9.18	9.05	9.70	10.52	11.38	10.02	10.55	10.71
03/16/01	9.35	9.54	9.37	9.12	9.35	9.14	9.81	10.57	11.38	10.05	10.60	10.80
03/29/01	9.54	9.86	9.57	9.28	9.55	9.60	9.32	9.42	9.61	9.53	10.04	10.03

TABLE 2

DEPTH TO WATER MEASUREMENTS (SELECTED WELLS)

(Depth in Feet T.O.C.)

Fourth Quarter 2000

Date	MW-4I	MW-4D	MW-4S	MW-6S	MW-6D	MW-7	MW-22S	MW-22D	MW-23D	MW-23S	MW-23I1	MW-23I2
10/6/2000	8.50	8.62	9.23	8.50	8.71	7.25	11.15	11.75	12.41	11.80	12.36	12.53
########	8.88	8.67	9.26	8.91	9.18	7.82	11.62	12.33	13.09	12.10	13.02	13.89
########	9.36	9.74	9.23	9.24	9.53	8.13	12.22	12.89	13.55	12.85	13.40	13.52
########	9.10	8.10	9.32	9.30	9.60	8.22	12.33	12.99	13.65	12.93	13.47	13.68
11/3/2000	8.92	9.10	9.31	8.26	9.06	8.21	10.59	10.28	10.60	10.97	11.49	11.48
########	8.10	8.24	8.40	7.92	8.15	7.84	8.57	8.56	8.80	8.87	9.26	9.35
########	8.02	8.20	8.17	7.80	7.98	7.95	8.24	8.30	8.48	8.47	8.97	8.98
########	8.49	8.48	8.44	8.53	8.57	8.59	8.22	8.28	8.49	8.45	9.01	9.02
12/8/2000	8.05	8.26	8.21	7.88	8.10	8.04	8.58	8.91	9.63	8.83	8.40	9.52
########	8.10	8.28	8.30	7.99	8.17	7.66	8.84	9.72	10.58	9.18	9.75	9.98
########	8.10	8.28	8.21	8.00	8.23	7.43	9.05	10.22	11.22	9.43	9.99	10.28

TABLE 2

DEPTH TO WATER MEASUREMENTS (SELECTED WELLS)

(Depth in Feet T.O.C.)

Third Quarter 2000

Date	MW-4I	MW-4D	MW-4S	MW-6S	MW-6D	MW-7	MW-22S	MW-22D	MW-23D	MW-23S	MW-23I1	MW-23I2
7/8/2000	11.89	12.05	11.64	11.82	12.07	10.92	14.05	14.00	15.58	15.07	15.52	15.68
7/15/2000	11.41	11.49	11.21	11.40	11.52	10.64	13.61	14.19	15.38	14.89	15.21	15.10
7/23/2000	10.90	11.21	11.88	11.09	11.25	10.02	13.33	13.89	15.09	14.21	14.78	14.91
8/4/2000	10.35	10.50	10.53	10.34	10.60	9.30	13.00	13.68	14.34	13.62	14.18	14.35
8/11/2000	10.21	10.31	10.34	10.25	10.42	9.26	12.42	12.35	12.81	12.57	13.07	13.12
8/25/2000	9.96	10.21	10.42	9.83	9.97	9.21	11.15	10.80	11.18	11.51	12.00	11.80
9/1/2000	10.32	10.80	10.55	10.71	10.79	9.62	13.05	13.84	14.05	13.74	14.21	14.72
9/8/2000	10.85	11.05	10.69	10.87	11.17	9.84	13.66	14.38	15.03	14.30	14.80	15.02
9/15/2000	10.24	10.40	10.03	10.20	10.47	9.30	13.17	13.90	14.23	13.68	14.07	14.19
9/22/2000	9.77	9.83	9.42	9.22	9.68	8.52	12.88	13.09	13.61	13.15	13.62	13.82
9/29/2000	9.15	9.34	9.38	8.74	9.13	8.12	12.47	12.56	13.13	12.51	13.04	13.22

TABLE 2

DEPTH TO WATER MEASUREMENTS (SELECTED WELLS)

(Depth In Feet T.O.C.)

Second Quarter 2000

Date	MW-4I	MW-4D	MW-4S	MW-6S	MW-6D	MW-7	MW-22S	MW-22D	MW-23D	MW-23S	MW-23I1	MW-23I2
4/14/2000	11.14	11.36	11.19	11.11	11.40	10.19	13.67	14.51	15.38	14.12	14.71	14.99
4/21/2000	11.32	11.47	11.30	11.41	11.71	10.37	13.79	14.83	15.61	14.28	14.89	15.10
4/28/2000	11.73	11.59	11.44	11.67	11.92	10.64	13.94	15.04	15.82	14.50	15.00	15.27
5/5/2000	11.91	11.89	11.73	11.83	12.05	10.95	14.16	15.23	15.95	14.63	15.18	15.43
5/12/2000	12.02	11.97	11.81	11.90	12.28	11.09	14.31	15.05	15.84	14.78	15.35	15.52
5/19/2000	12.23	12.26	12.05	12.00	12.30	11.19	14.42	15.00	15.05	14.95	15.50	15.65
5/26/2000	12.38	12.47	12.32	12.30	12.45	11.38	14.03	15.45	15.92	15.31	15.87	15.92
6/2/2000	12.52	12.75	12.53	12.50	12.82	11.72	14.99	15.61	16.25	15.55	16.10	16.21
6/9/2000	12.47	12.70	12.65	12.50	12.78	11.55	14.97	15.58	16.14	15.54	16.00	16.23
6/16/2000	12.30	12.55	12.45	12.33	12.55	11.46	14.72	15.37	15.84	15.30	15.87	16.02
6/26/2000	12.28	12.43	12.07	12.28	12.48	11.22	14.71	15.32	15.95	15.32	15.85	16.01

TABLE 2

DEPTH TO WATER MEASUREMENTS (SELECTED WELLS)

(Depth In Feet T.O.C.)

First Quarter 2000

Date	MW-4I	MW-4D	MW-4S	MW-6S	MW-6D	MW-7	MW-22S	MW-22D	MW-23D	MW-23S	MW-23I1	MW-23I2
1/7/2000	9.16	9.29	9.45	9.06	9.35	8.28	11.02	11.97	11.41	11.48	11.94	11.93
1/14/2000	9.30	9.34	9.42	9.25	9.55	8.49	11.20	11.62	12.08	11.50	12.00	11.85
1/21/2000	9.52	9.54	9.49	9.47	9.83	8.61	11.77	12.91	13.05	12.22	12.81	12.71
1/28/2000	9.73	9.81	9.73	9.80	10.04	8.72	12.36	13.30	13.96	12.94	13.55	13.07
2/4/2000	9.93	10.17	9.99	9.96	10.36	8.59	12.93	13.84	14.57	13.60	14.10	14.32
2/11/2000	9.96	10.22	10.08	9.99	10.41	9.02	12.88	13.80	14.55	13.52	14.01	14.24
2/18/2000	10.09	10.33	10.18	10.09	10.40	9.15	12.83	13.77	14.52	13.40	13.95	14.17
2/25/2000	10.56	10.61	10.55	10.47	10.73	9.41	13.04	13.90	14.74	14.72	14.15	14.31
3/3/2000	10.60	10.84	10.69	10.69	10.96	9.61	13.30	14.09	14.81	13.90	14.40	14.51
3/10/2000	10.71	10.91	10.74	10.73	10.99	9.72	13.32	14.11	14.85	13.92	14.42	14.53
3/17/2000	10.76	10.94	10.79	10.77	11.01	9.76	13.31	14.13	14.86	13.90	14.43	14.61
3/24/2000	10.95	11.00	10.84	10.81	11.05	9.85	13.33	14.14	14.90	13.90	14.44	14.64
4/3/2000	11.07	11.20	11.05	10.97	11.26	10.05	13.49	14.38	15.22	14.03	14.60	14.81

TABLE 2

WATER TABLE ELEVATIONS "Wet Season" - "Dry Season"

Well #	November 1999 DTW	November 1999 El. MSL	November 1999 DTW-MSL	November 1999 Depth Class	June 2000 DTW	June 2000 El. MSL	June 2000 DTW-MSL	June 2000 Depth Class
MW-1	5.65'	20.53'	14.88'	S	12.71'	20.53'	7.82'	S
MW-2(89)	5.73'	20.76'	15.03'	S				
MW-2(93)	5.75'	20.62'	14.87'	S	12.70'	20.62'	7.92'	S
MW-3	5.57'				11.89'	20.76	8,87	S
MW-4(s)	5.74'	20.71'	14.97'	S	12.53'	20.71'	8.18'	S
MW-4(I)	5.62'	20.62'	15.00'	I	12.52'	20.62'	8.10'	I
MW-4(d)	5.79'	20.77'	14.98'	D	12.75'	20.77'	8.02'	D
MW-5	5.75'	20.55'	14.80'	S	12.75'	20.55'	7.80'	S
MW-6(s)	5.46'	20.32'	14.86'	I	12.50'	20.32'	7.82'	I
MW-6(d)	5.56'	20.44'	14.88'	D	12.82'	20.44'	7.62'	D
MW-7	5.60'	21.05'	15.45'	I	11.72'	21.05'	9.33'	I
MW-8	6.78'	22.12'	15.94'	I	12.53'	22.12'	9.59'	I
MW-9	7.30'	22.43'	15.13'	D	13.25'	22.43'	9.18'	D
MW-10	6.56'	21.71'	15.15'	I	12.65'	21.71'	9.06'	I
MW-11	5.70'	20.72'	15.02'	S	12.43'	20.72'	8.29'	S
MW-12	4.90'	19.95'	15.05'	I	11.27'	19.95'	8.68'	I
MW-14(s)	5.92'	20,04'	14.21'	S	12.45'	20.04'	7.59'	S
MW-14(d)	5.50'	20.38'	14.88'	I	12.16'	20.38'	8.22'	I
MW-15	5.85'	20.53'	14.68'	D	12.38'	20.53'	8.15'	D
MW-16	6.33'	20.83'	14.50'	I	13.72'	20.83'	7.11'	I
MW-17	6.55'	20.98'	14.43'	I	15.02'	20.98'	5.95'	I
MW-18	6.01'	20.34'	14.33'	I	13.22'	20.34'	7.12'	I
MW-19	6.33'	20.46'	14.13'	D	15.32'	20.46'	5.14'	D
MW-20	6.62'	20.53'	13.91'	D	17.40'	20.53'	3.13'	D
MW-22(s)	5.83'	20.07'	14.24'	I	14.99'	20.07'	5.08'	I
MW-22(d)	6.14'	20.10'	13.96'	D	15.61'	10.10'	4.49'	D
MW-23(s)	5.98'	20.20'	14.22'	I	15.55'	20.20'	4.65'	I
MW-23(d)	6.36'	20.53'	13.87'	D	16.25'	20.23'	3.98	D

TABLE 4 (contd.)

WATER TABLE ELEVATIONS "Wet Season" - "Dry Season"

	November 1999				June 2000			
Well #	DTW	El. MSL	DTW-MSL	Depth Class	DTW	El. MSL	DTW-MSL	Depth Class
MW-23I1	6.46'	20.71'	14.25'	I	16.10'	20.71'	4.61'	I
MW-23I2	6.51'	20.72'	14.21	I	16.21'	20.72'	4.51'	I

Remarks: End of "Wet Season" November 1999
End of "Dry Season" June 2000

Depth Class: S = 0' - 30'
I = 30' - 60'
D = 60' - ++

TABLE 3

MONITOR WELL - GROUNDWATER QUALITY ANALYSIS
(data in ug/L)

Well #	June 2003 1,1-Dichlor. (mcl 7.0 ug/L)	June 2003 cis-1,2-Dichlor. (mcl 70.0 ug/L)	June 2003 Trichlor. (mcl 3.0 ug/L)	June 2003 Vinyl Chloride mcl 1.0 ug/L)	December 2002 1,1-Dichlor. (mcl 7.0 ug/L)	December 2002 cis-1,2-Dichlor. (mcl 70.0 ug/L)	December 2002 Trichlor. (mcl 3.0 ug/L)	December 2002 Vinyl Chloride mcl 1.0 ug/L)
MW-1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-2(89)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-2(93)	0.00	0.00	12.50	1.00	0.00	0.00	7.90	0.00
MW-4(I)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-4S	0.00	0.00	9.10	0.00	0.00	0.00	21.50	0.00
MW-4D	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.10
MW-5	0.00	0.00	5.00	0.00	0.00	0.00	4.70	0.00
MW-6S	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-6D	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ext. Well	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-14S	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-14D	0.00	0.00	0.00	3.70	0.00	0.00	0.00	8.00
MW-15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CVB #15	0.00	0.00	0.00	10.10	0.00	47.00	0.00	9.90
MW-16	0.00	109.00	0.00	18.80	0.00	0.00	0.00	13.20
MW-17	0.00	0.00	0.00	2.00	0.00	0.00	0.00	3.30
MW-18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-19	0.00	0.00	0.00	3.60	0.00	0.00	0.00	67.60
MW-20	0.00	0.00	0.00	1.60	0.00	0.00	0.00	5.70
MW-22S	0.00	0.00	0.00	13.10	0.00	137.00	0.00	0.00
MW-22D	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.40
MW-23S	0.00	0.00	0.00	2.90	0.00	0.00	0.00	15.90
MW-23D	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.90

Well #	June 2003				December 2002			
	1,1-Dichlor. (mcl 7.0 ug/L)	cis-1,2-Dichlor. (mcl 70.0 ug/L)	Trichlor. (mcl 3.0 ug/L)	Vinyl Chloride mcl 1.0 ug/L)	1,1-Dichlor. (mcl 7.0 ug/L)	cis-1,2-Dichlor. (mcl 70.0 ug/L)	Trichlor. (mcl 3.0 ug/L)	Vinyl Chloride mcl 1.0 ug/L)
MW-23I1	0.00	0.00	0.00	10.20	0.00	0.00	0.00	32.90
MW-23I2	0.00	231.00	0.00	204.00	0.00	98.10	0.00	92.70
UVB-1A (I)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.90
UVB-2 (I)	0.00	0.00	0.00	0.00	0.00	72.60	0.00	95.40

No sample collected

Well not in operation. No sample collected

No sample collected

Well not in operation. No sample collected

TABLE 3

MONITOR WELL - GROUNDWATER QUALITY ANALYSIS
(data in ug/L)

Well #	December 2002 1,1-Dichlor. (mcl 7.0 ug/L)	December 2002 cis-1,2-Dichlor. (mcl 70.0 ug/L)	December 2002 Trichlor. (mcl 3.0 ug/L)	December 2002 Vinyl Chloride mcl 1.0 ug/L)	June 2002 1,1-Dichlor. (mcl 7.0 ug/L)	June 2002 cis-1,2-Dichlor. (mcl 70.0 ug/L)	June 2002 Trichlor. (mcl 3.0 ug/L)	June 2002 Vinyl Chloride mcl 1.0 ug/L)
MW-1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-2(89)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-2(93)	0.00	0.00	7.90	0.00	0.00	0.00	0.00	0.00
MW-4(I)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-4S	0.00	0.00	21.50	0.00	0.00	0.00	14.30	0.00
MW-4D	0.00	0.00	0.00	4.10	0.00	0.00	0.00	0.00
MW-5	0.00	0.00	4.70	0.00	0.00	0.00	3.40	0.00
MW-6S	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-6D	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ext. Well	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-14S	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-14D	0.00	0.00	0.00	8.00	0.00	0.00	0.00	0.00
MW-15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CVB #15	0.00	47.00	0.00	9.90	0.00	51.20	0.00	14.30
MW-16	0.00	0.00	0.00	13.20	0.00	152.00	0.00	49.70
MW-17	0.00	0.00	0.00	3.30	0.00	0.00	0.00	4.70
MW-18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-19	0.00	0.00	0.00	67.60	0.00	201.00	0.00	283.00
MW-20	0.00	0.00	0.00	5.70	0.00	0.00	0.00	5.70
MW-22S	0.00	137.00	0.00	0.00	0.00	178.00	0.00	142.00
MW-22D	0.00	0.00	0.00	1.40	0.00	0.00	0.00	7.50
MW-23S	0.00	0.00	0.00	15.90	0.00	0.00	0.00	6.00
MW-23D	0.00	0.00	0.00	1.90	0.00	0.00	0.00	0.00

December 2002

Well #	1,1-Dichlor. (mcl 7.0 ug/L)	cis-1,2-Dichlor. (mcl 70.0 ug/L)	Trichlor. (mcl 3.0 ug/L)	Vinyl Chloride mcl 1.0 ug/L)
MW-23I1	0.00	0.00	0.00	32.90
MW-23I2	0.00	98.10	0.00	92.70
UVB-1A (I)	0.00	0.00	0.00	9.90
UVB-2 (I)	0.00	72.60	0.00	95.40

No sample collected

Well not in operation. No sample collected

June 2002

Well #	1,1-Dichlor. (mcl 7.0 ug/L)	cis-1,2-Dichlor. (mcl 70.0 ug/L)	Trichlor. (mcl 3.0 ug/L)	Vinyl Chloride mcl 1.0 ug/L)
MW-23I1	0.00	0.00	0.00	0.00
MW-23I2	0.00	86.20	0.00	51.70
UVB-1A (I)	0.00	0.00	0.00	9.90
UVB-2 (I)	##	##	##	##

No sample collected

Well not in operation. No sample collected

TABLE 3

MONITOR WELL - GROUNDWATER QUALITY ANALYSIS
(data in ug/L)

Well #	June 2002				December 2001			
	1,1-Dichlor. (mcl 7.0 ug/L)	cis-1,2-Dichlor. (mcl 70.0 ug/L)	Trichlor. (mcl 3.0 ug/L)	Vinyl Chloride mcl 1.0 ug/L)	1,1-Dichlor. (mcl 7.0 ug/L)	cis-1,2-Dichlor. (mcl 70.0 ug/L)	Trichlor. (mcl 3.0 ug/L)	Vinyl Chloride mcl 1.0 ug/L)
MW-1	0.00	0.00	0.00	0.00	0.00	0.00	3.20	0.00
MW-2(89)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-2(93)	0.00	0.00	0.00	0.00	0.00	0.00	7.90	0.00
MW-4(I)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-4S	0.00	0.00	14.30	0.00	0.00	0.00	22.20	0.00
MW-4D	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.00
MW-5	0.00	0.00	3.40	0.00	0.00	0.00	0.00	25.40
MW-6S	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-6D	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.80
MW-7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ext. Well	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.30
MW-11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-14S	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.80
MW-14D	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.00
MW-15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CVB #15	0.00	51.20	0.00	14.30	##	##	##	##
MW-16	0.00	152.00	0.00	49.70	0.00	81.40	0.00	53.40
MW-17	0.00	0.00	0.00	4.70	0.00	0.00	4.60	1.11
MW-18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-19	0.00	201.00	0.00	283.00	0.00	34.70	0.00	208.00
MW-20	0.00	0.00	0.00	5.70	0.00	0.00	0.00	0.00
MW-22S	0.00	178.00	0.00	142.00	0.00	0.00	0.00	37.70
MW-22D	0.00	0.00	0.00	7.50	0.00	0.00	0.00	3.60
MW-23S	0.00	0.00	0.00	6.00	0.00	0.00	0.00	3.60
MW-23D	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.10

Well #	June 2002 1,1-Dichlor. (mcl 7.0 ug/L)	June 2002 cis-1,2-Dichlor. (mcl 70.0 ug/L)	June 2002 Trichlor. (mcl 3.0 ug/L)	June 2002 Vinyl Chloride mcl 1.0 ug/L)	December 2001 1,1-Dichlor. (mcl 7.0 ug/L)	December 2001 cis-1,2-Dichlor. (mcl 70.0 ug/L)	December 2001 Trichlor. (mcl 3.0 ug/L)	December 2001 Vinyl Chloride mcl 1.0 ug/L)
MW-23I1	0.00	0.00	0.00	0.00	0.00	69.80	0.00	3.10
MW-23I2	0.00	86.20	0.00	51.70	0.00	61.50	0.00	43.60
UVB-1A (I)	0.00	0.00	0.00	9.90	0.00	0.00	0.00	1.90
UVB-2 (I)	##	##	##	##	0.00	111.00	0.00	59.20

June 2002:

No sample collected

Well not in operation. No sample collected

December 2001:

No sample collected

Well not in operation. No sample collected

TABLE 3

MONITOR WELL - GROUNDWATER QUALITY ANALYSIS
(data in ug/L)

Well #	December 2001 1,1-Dichlor. (mcl 7.0 ug/L)	December 2001 cis-1,2-Dichlor. (mcl 70.0 ug/L)	December 2001 Trichlor. (mcl 3.0 ug/L)	December 2001 Vinyl Chloride mcl 1.0 ug/L)	June 2001 1,1-Dichlor. (mcl 7.0 ug/L)	June 2001 cis-1,2-Dichlor. (mcl 70.0 ug/L)	June 2001 Trichlor. (mcl 3.0 ug/L)	June 2001 Vinyl Chloride mcl 1.0 ug/L)
MW-1	0.00	0.00	3.20	0.00	0.00	0.00	0.00	0.00
MW-2(89)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-2(93)	0.00	0.00	7.90	0.00	0.00	0.00	0.00	0.00
MW-4(I)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-4S	0.00	0.00	22.20	0.00	0.00	0.00	32.80	0.00
MW-4D	0.00	0.00	0.00	6.00	0.00	0.00	0.00	4.40
MW-5	0.00	0.00	0.00	25.40	0.00	0.00	0.00	0.00
MW-6S	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-6D	0.00	0.00	0.00	1.80	0.00	0.00	0.00	1.80
MW-7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ext. Well	0.00	0.00	0.00	4.30	0.00	0.00	0.00	0.00
MW-11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-14S	0.00	0.00	0.00	4.80	0.00	0.00	0.00	0.00
MW-14D	0.00	0.00	0.00	6.00	0.00	0.00	0.00	0.00
MW-15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CVB #15	##	##	##	##	##	##	##	##
MW-16	0.00	81.40	0.00	53.40	0.00	0.00	0.00	0.00
MW-17	0.00	0.00	4.60	1.11	0.00	0.00	0.00	2.60
MW-18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-19	0.00	34.70	0.00	208.00	0.00	34.70	0.00	5.70
MW-20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-22S	0.00	0.00	0.00	37.70	0.00	0.00	0.00	4.40
MW-22D	0.00	0.00	0.00	3.60	0.00	0.00	0.00	5.40
MW-23S	0.00	0.00	0.00	3.60	0.00	0.00	0.00	48.90
MW-23D	0.00	0.00	0.00	3.10	0.00	0.00	0.00	5.40

Well #	December 2001 1,1-Dichlor. (mcl 7.0 ug/L)	December 2001 cis-1,2-Dichlor. (mcl 70.0 ug/L)	December 2001 Trichlor. (mcl 3.0 ug/L)	December 2001 Vinyl Chloride mcl 1.0 ug/L)	June 2001 1,1-Dichlor. (mcl 7.0 ug/L)	June 2001 cis-1,2-Dichlor. (mcl 70.0 ug/L)	June 2001 Trichlor. (mcl 3.0 ug/L)	June 2001 Vinyl Chloride mcl 1.0 ug/L)
MW-23I1	0.00	69.80	0.00	3.10	0.00	130.00	0.00	42.30
MW-23I2	0.00	61.50	0.00	43.60	0.00	225.00	0.00	113.00
UVB-1A (I)	0.00	0.00	0.00	1.90	0.00	0.00	0.00	1.90
UVB-2 (I)	0.00	111.00	0.00	59.20	0.00	74.30	0.00	42.40

No sample collected

Well not in operation. No sample collected

No sample collected

Well not in operation. No sample collected

TABLE 3

MONITOR WELL - GROUNDWATER QUALITY ANALYSIS

(data in ug/L)

Well #	June 2001 1,1-Dichlor. (mcl 7.0 ug/L)	June 2001 cis-1,2-Dichlor. (mcl 70.0 ug/L)	June 2001 Trichlor. (mcl 3.0 ug/L)	June 2001 Vinyl Chloride mcl 1.0 ug/L)	December 2000 1,1-Dichlor. (mcl 7.0 ug/L)	December 2000 cis-1,2-Dichlor. (mcl 70.0 ug/L)	December 2000 Trichlor. (mcl 3.0 ug/L)	December 2000 Vinyl Chloride mcl 1.0 ug/L)
MW-1	0.00	0.00	0.00	0.00	0.00	2.10	4.80	0.00
MW-2(89)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-2(93)	0.00	0.00	0.00	0.00	#	#	#	#
MW-4(I)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-4S	0.00	0.00	32.80	0.00	0.00	5.40	16.00	0.00
MW-4D	0.00	0.00	0.00	4.40	0.00	0.00	0.00	0.00
MW-5	0.00	0.00	0.00	0.00	0.00	11.50	2.60	0.00
MW-6S	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-6D	0.00	0.00	0.00	1.80	0.00	1.40	0.00	0.00
MW-7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-10	0.00	0.00	0.00	0.00	0.00	2.40	0.00	0.00
Ext. Well	0.00	0.00	0.00	0.00	0.00	10.80	0.00	6.00
MW-11	0.00	0.00	0.00	0.00	0.00	2.20	1.50	0.00
MW-12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-14S	0.00	0.00	0.00	0.00	11.90	686.00	25.80	55.10
MW-14D	0.00	0.00	0.00	0.00	0.00	8.40	0.00	345.00
MW-15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CVB #15	##	##	##	##	##	##	##	##
MW-16	0.00	0.00	0.00	0.00	1.00	72.80	0.00	71.60
MW-17	0.00	0.00	0.00	2.60	0.00	6.90	0.00	1.90
MW-18	0.00	0.00	0.00	0.00	0.00	2.70	0.00	0.00
MW-19	0.00	34.70	0.00	5.70	7.50	283.00	0.00	147.00
MW-20	0.00	0.00	0.00	0.00	0.00	6.40	0.00	2.20
MW-22S	0.00	0.00	0.00	4.40	0.00	71.40	0.00	46.10
MW-22D	0.00	0.00	0.00	5.40	0.00	5.10	0.00	6.10
MW-23S	0.00	0.00	0.00	48.90	0.00	75.30	0.00	35.00
MW-23D	0.00	0.00	0.00	5.40	0.00	2.50	0.00	2.20

Well #	June 2001 1,1-Dichlor. (mcl 7.0 ug/L)	June 2001 cis-1,2-Dichlor. (mcl 70.0 ug/L)	June 2001 Trichlor. (mcl 3.0 ug/L)	June 2001 Vinyl Chloride mcl 1.0 ug/L)	December 2000 1,1-Dichlor. (mcl 7.0 ug/L)	December 2000 cis-1,2-Dichlor. (mcl 70.0 ug/L)	December 2000 Trichlor. (mcl 3.0 ug/L)	December 2000 Vinyl Chloride mcl 1.0 ug/L)
MW-23I1	0.00	130.00	0.00	42.30	0.00	74.30	0.00	22.10
MW-23I2	0.00	225.00	0.00	113.00	1.50	99.60	0.00	157.00
UVB-1A (I)	0.00	0.00	0.00	1.90	0.00	0.00	0.00	0.00
UVB-2 (I)	0.00	74.30	0.00	42.40	0.00	66.80	0.00	57.10

\# No sample collected

\## Well not in operation. No sample collected

TABLE 3

MONITOR WELL - GROUNDWATER QUALITY ANALYSIS
(data in ug/L)

Well #	May 2000 1,1-Dichlor. (mcl 7.0 ug/L)	May 2000 cis-1,2-Dichlor. (mcl 70.0 ug/L)	May 2000 Trichlor. (mcl 3.0 ug/L)	May 2000 Vinyl Chloride mcl 1.0 ug/L)	December 2000 1,1-Dichlor. (mcl 7.0 ug/L)	December 2000 cis-1,2-Dichlor. (mcl 70.0 ug/L)	December 2000 Trichlor. (mcl 3.0 ug/L)	December 2000 Vinyl Chloride mcl 1.0 ug/L)
MW-1	0.00	25.50	55.20	2.60	0.00	2.10	4.80	0.00
MW-2(89)	0.00	6.60	3.40	1.80	0.00	0.00	0.00	0.00
MW-2(93)	0.00	13.00	21.90	0.00	#	#	#	#
MW-4(I)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-4S	0.00	8.60	26.20	0.00	0.00	5.40	16.00	0.00
MW-4D	0.00	1.70	0.00	1.50	0.00	0.00	0.00	0.00
MW-5	0.00	16.10	4.00	0.00	0.00	11.50	2.60	0.00
MW-6S	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-6D	0.00	2.80	0.00	2.60	0.00	1.40	0.00	0.00
MW-7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-10	0.00	0.00	0.00	0.00	0.00	2.40	0.00	0.00
Ext. Well	0.00	0.00	1.20	0.00	0.00	10.80	0.00	6.00
MW-11	0.00	5.40	18.40	0.00	0.00	2.20	1.50	0.00
MW-12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MW-14S	0.00	3.60	2.80	0.00	11.90	686.00	25.80	55.10
MW-14D	0.00	50.60	0.00	434.00	0.00	8.40	0.00	345.00
MW-15	0.00	0.99	0.00	0.00	0.00	0.00	0.00	0.00
CVB #15	0.00	59.70	0.00	9.80	##	##	##	##
MW-16	0.00	150.00	0.00	90.30	1.00	72.80	0.00	71.60
MW-17	0.00	6.00	0.00	1.30	0.00	6.90	0.00	1.90
MW-18	0.00	1.20	0.00	0.00	0.00	2.70	0.00	0.00
MW-19	2.30	62.80	0.00	19.30	7.50	283.00	0.00	147.00
MW-20	0.00	71.20	0.00	6.30	0.00	6.40	0.00	2.20
MW-22S	0.00	90.70	0.00	10.50	0.00	71.40	0.00	46.10
MW-22D	0.00	1.80	0.00	0.00	0.00	5.10	0.00	6.10
MW-23S	0.00	180.00	0.00	11.10	0.00	75.30	0.00	35.00
MW-23D	0.00	6.50	0.00	3.60	0.00	2.50	0.00	2.20

Well #	May 2000 1,1-Dichlor. (mcl 7.0 ug/L)	May 2000 cis-1,2-Dichlor. (mcl 70.0 ug/L)	May 2000 Trichlor. (mcl 3.0 ug/L)	May 2000 Vinyl Chloride mcl 1.0 ug/L)	December 2000 1,1-Dichlor. (mcl 7.0 ug/L)	December 2000 cis-1,2-Dichlor. (mcl 70.0 ug/L)	December 2000 Trichlor. (mcl 3.0 ug/L)	December 2000 Vinyl Chloride mcl 1.0 ug/L)
MW-23I1	0.00	89.30	0.00	10.60	0.00	74.30	0.00	22.10
MW-23I2	0.00	126.00	0.00	22.50	1.50	99.60	0.00	157.00
UVB-1 (I)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
UVB-2 (I)	0.00	10.60	0.00	6.60	0.00	66.80	0.00	57.10

No sample collected

Well not in operation. No sample collected

TABLE 4

Applicable or Relevant and Appropriate Requirements

(A R A R s)

The groundwater cleanup standards in the ROD are based on both federal and state MCLs. These are listed below for the Chemicals Of Concern (COC).

Constituent	**Federal MCL (ug/L)**	**State MCL (ug/L)**
Trichloroethylene	5.0	3.0
1,1-Dichloroethylene	7.0	7.0
cis-1,2-Dichloroethylene	70.0	70.0
trans-1,2-Dichloroethylene	100.0	100.0
Vinyl Chloride	2.0	1.0

FIGURES

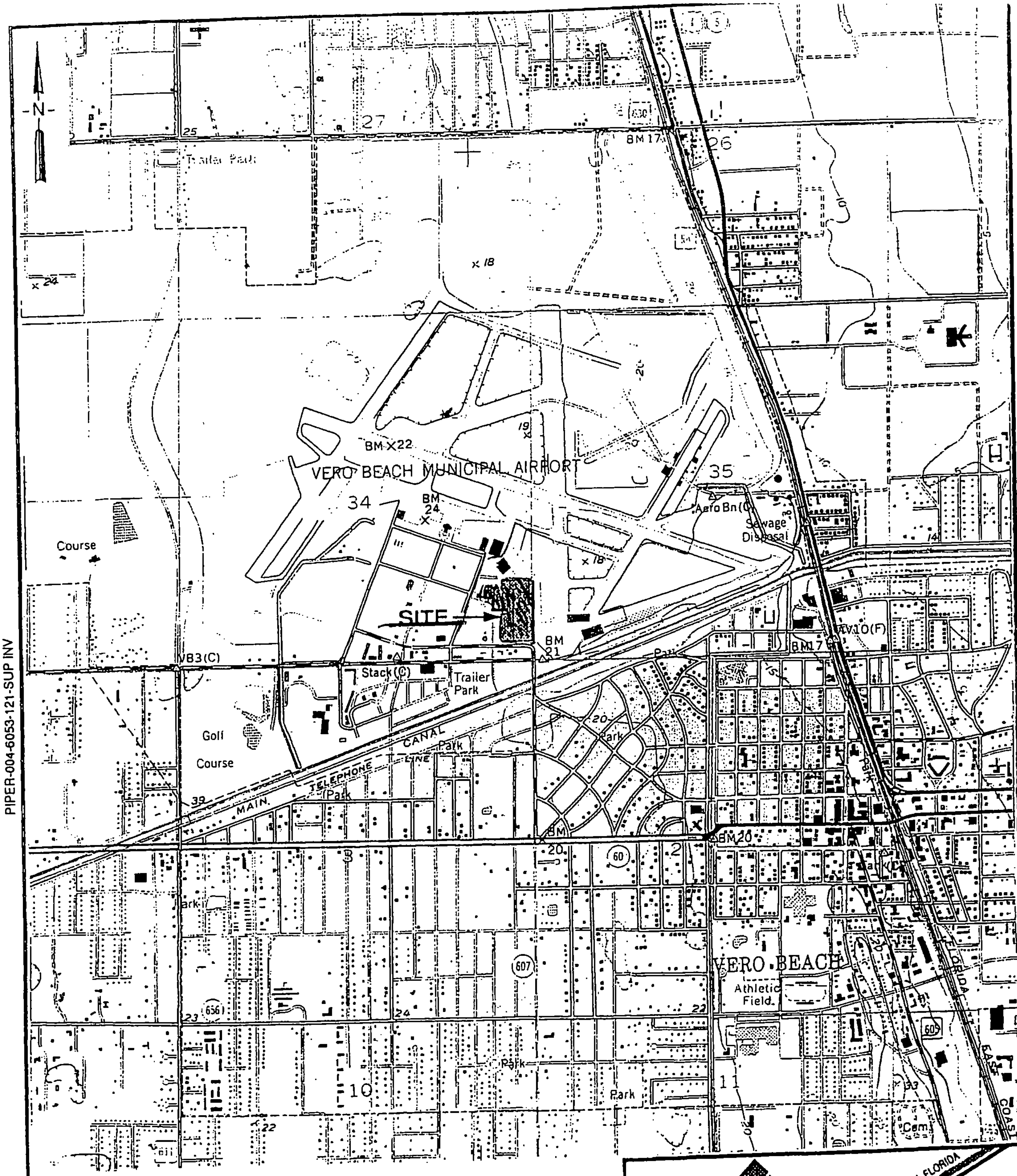
U.S. EPA REGION IV

SDMS

POOR LEGIBILITY

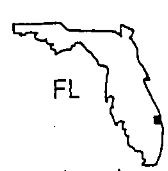
PORTIONS OF THIS DOCUMENT MAY BE UNREADABLE, DUE TO THE QUALITY OF THE ORIGINAL

*PLEASE CONTACT THE APPROPRIATE RECORDS CENTER TO VIEW THE MATERIAL



0 2000 4000

SCALE IN FEET



Quadrangle Location

BASE MAP SOURCE: USGS 7 1/2 minute topographic quadrangle map Vero Beach, Florida 1949, photorevised 1983.

Piper
THE NEW PIPER AIRCRAFT, INC.

VERO BEACH, FLORIDA

FIGURE 1
SITE VICINITY MAP

PIPER-004-6053-121-SUP INV

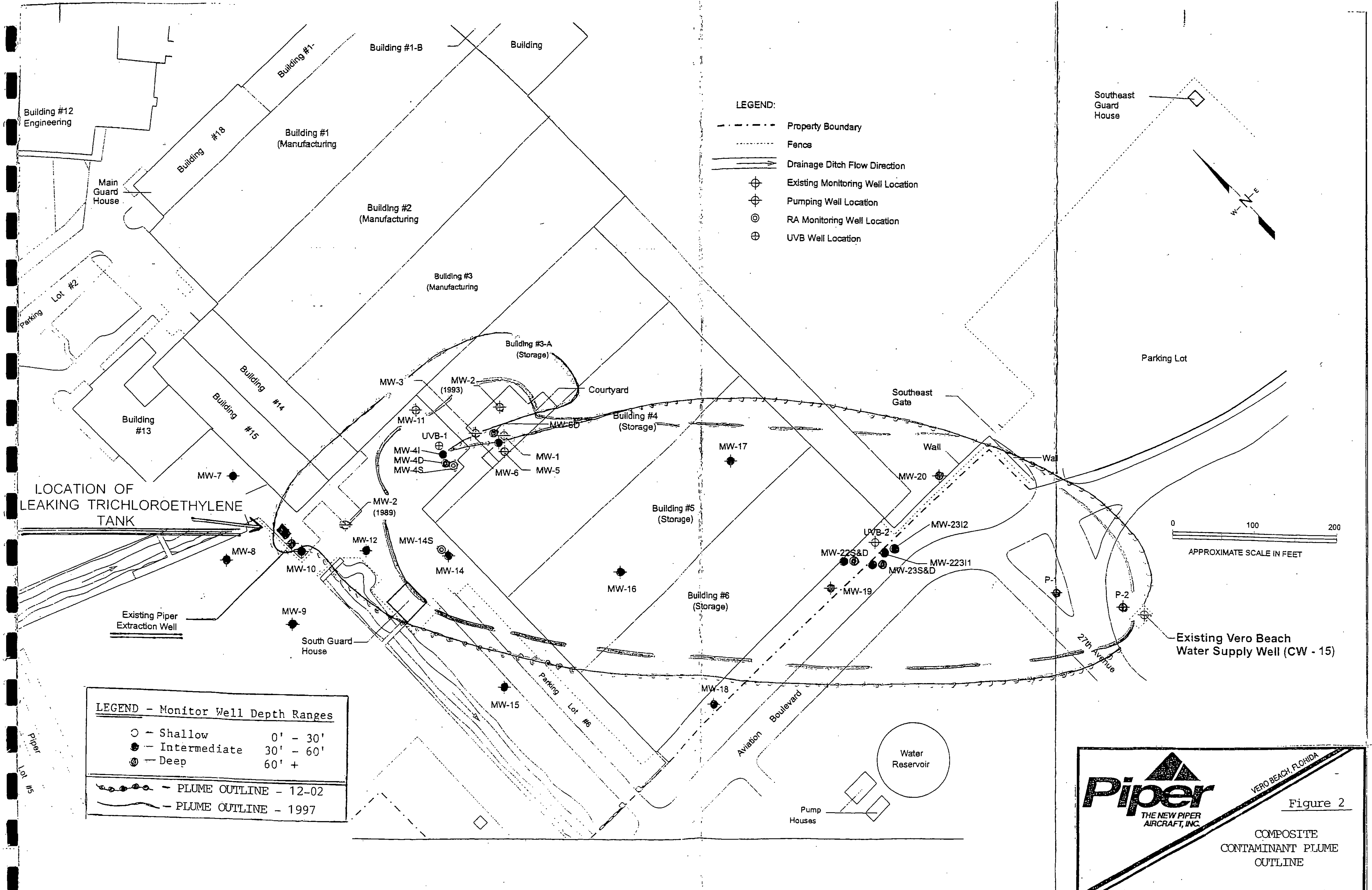


Figure 2

COMPOSITE CONTAMINANT PLUME OUTLINE

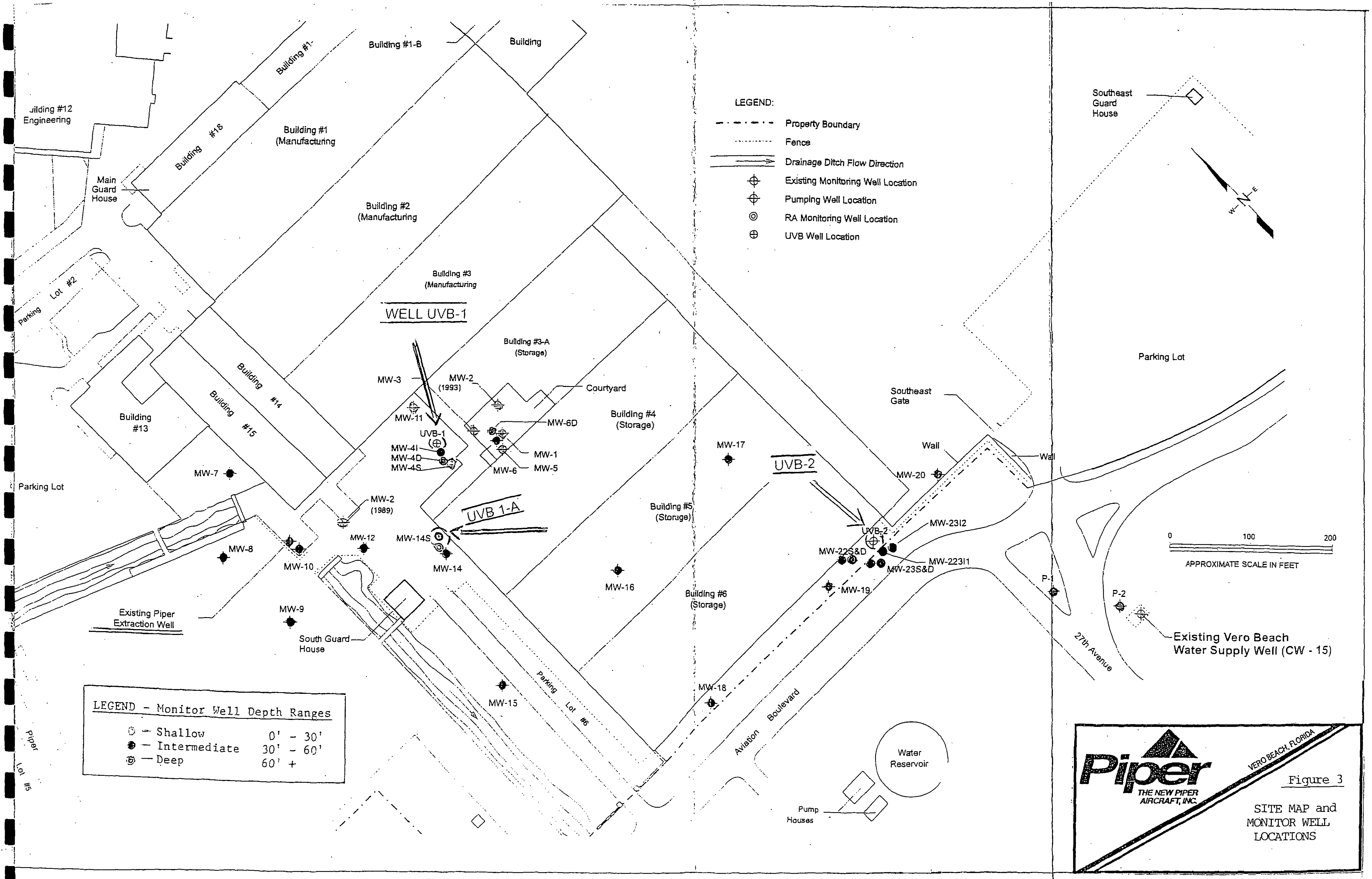
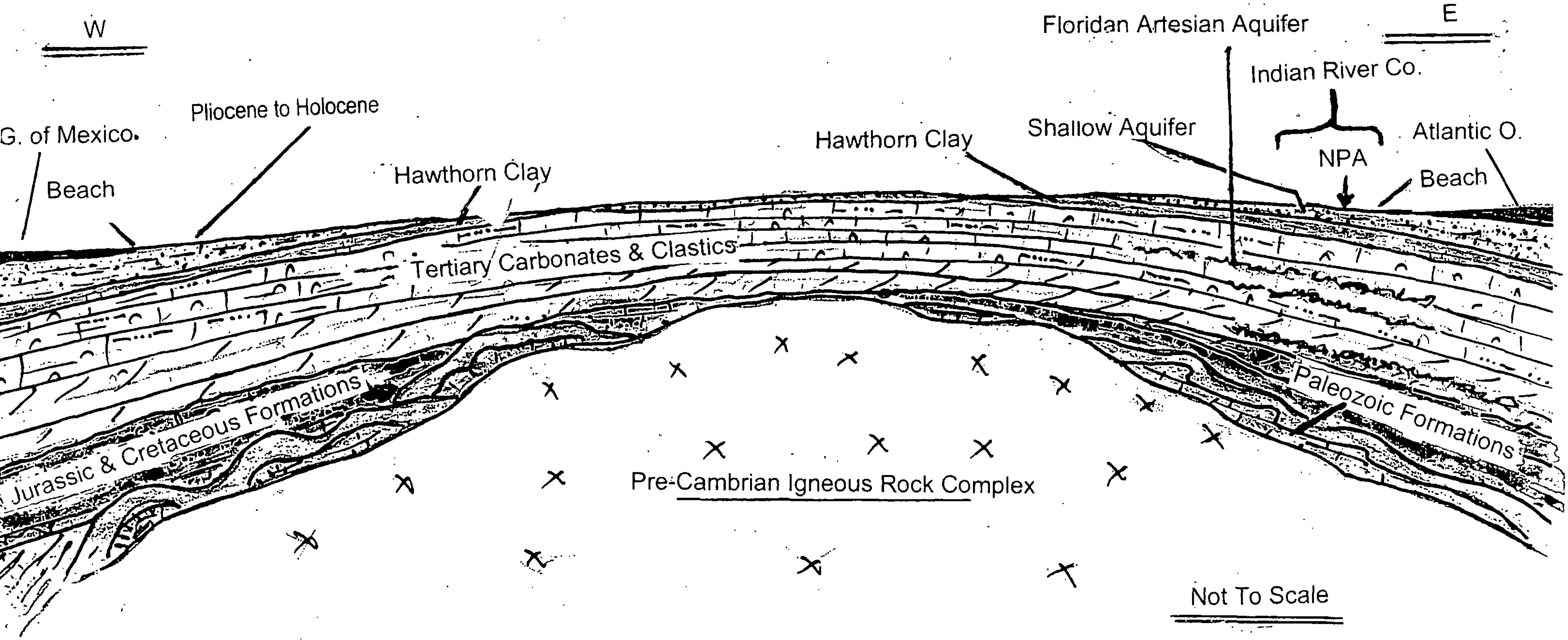


Figure 3

SITE MAP and MONITOR WELL LOCATIONS

GENERALIZED REGIONAL GEOLOGIC CROSS SECTION AT

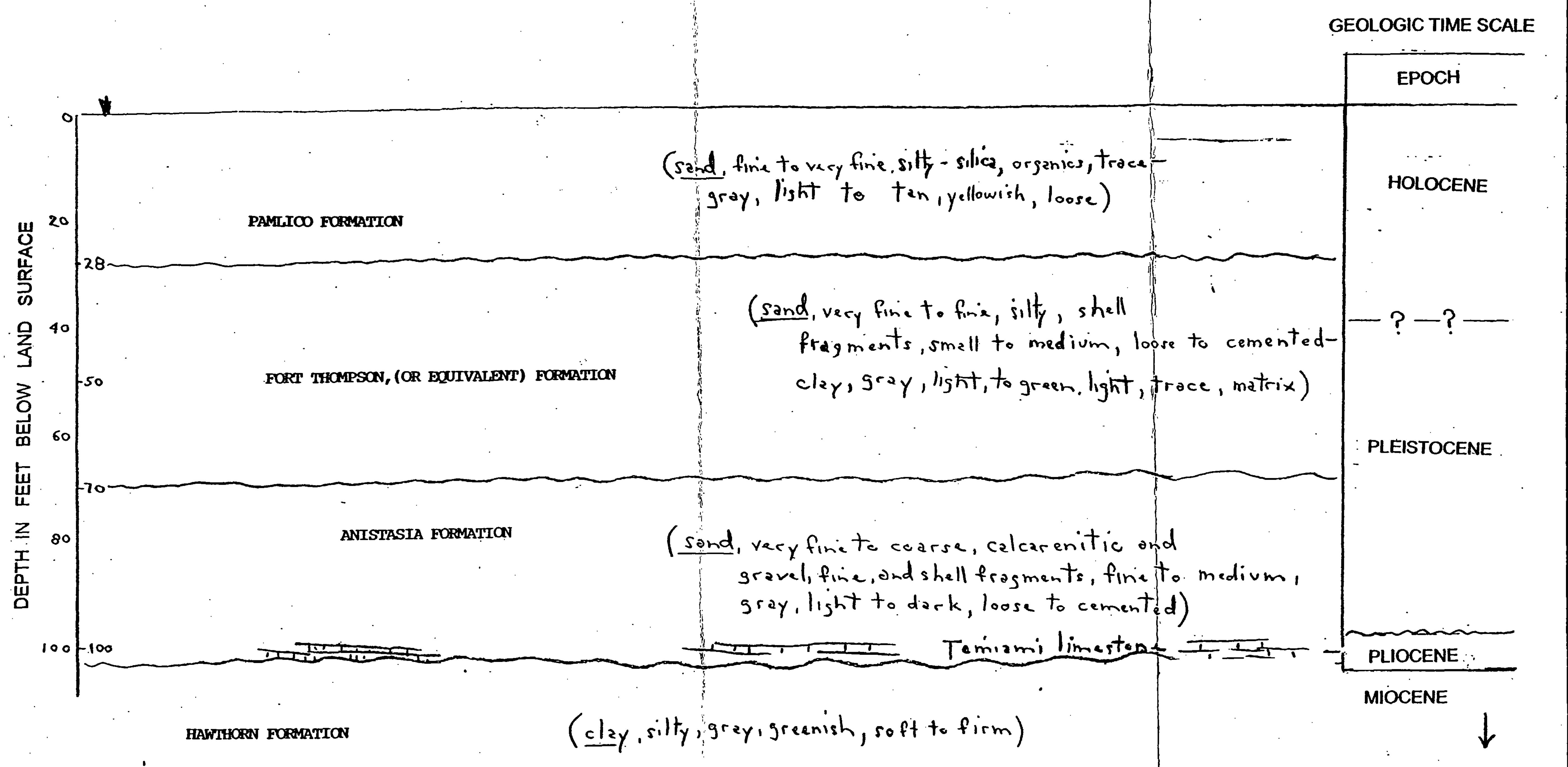
VERO BEACH, FLORIDA LATITUDE.



Not To Scale

FIG.4

Piper
THE NEW PIPER AIRCRAFT, INC.
2926 Piper Drive,



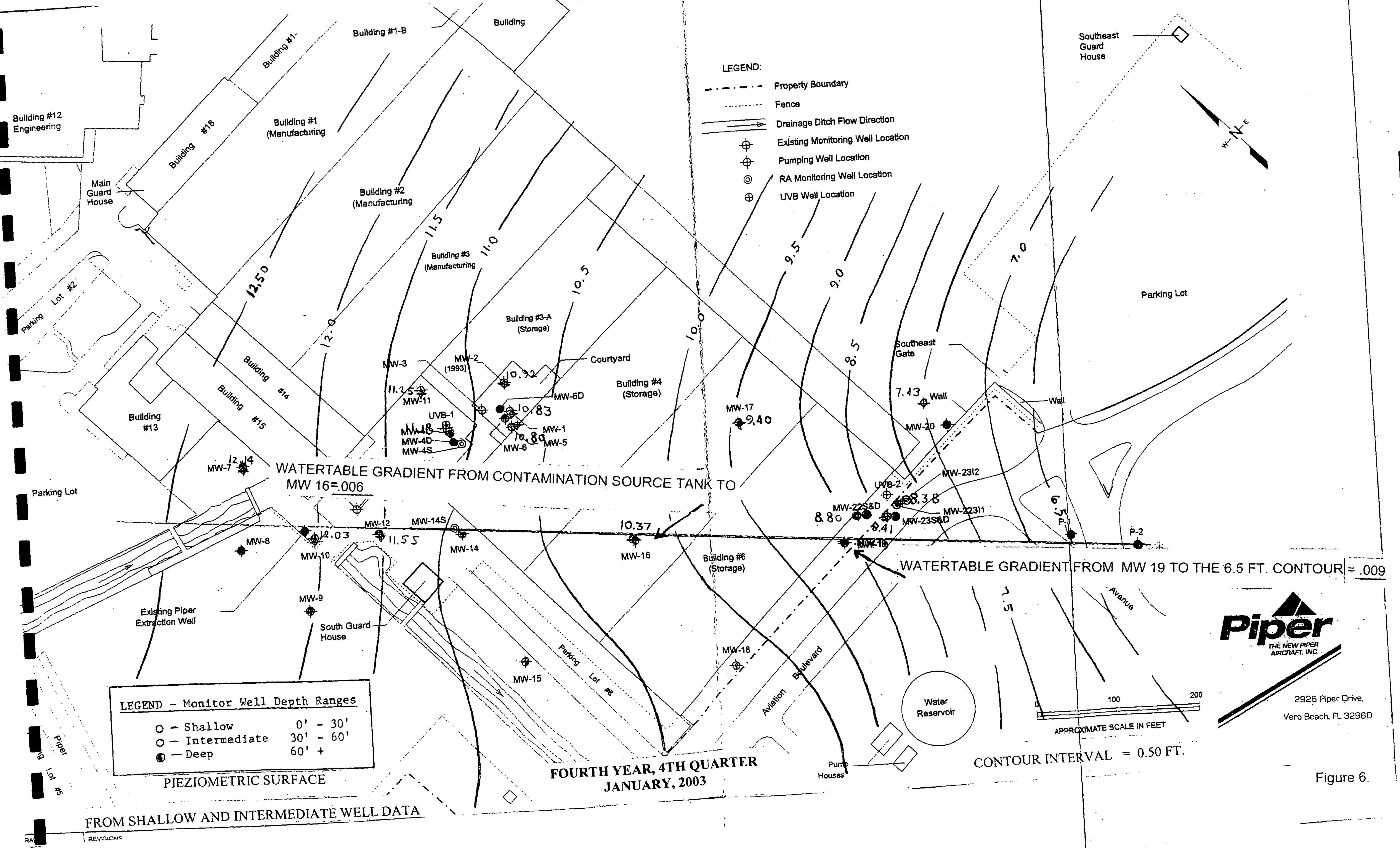
GENERALIZED SITE GEOLOGY

SHALLOW AQUIFER

Piper
THE NEW PIPER AIRCRAFT, INC.
VERO BEACH, FLORIDA

Figure 4A

SITE GEOLOGY
"SHALLOW AQUIFER"



Piper
THE NEW PIPER AIRCRAFT, INC.
2926 Piper Drive,
Vero Beach, FL 32960

Figure 6.

PIEZIOMETRIC SURFACE
FROM SHALLOW AND INTERMEDIATE WELL DATA

FOURTH YEAR, 4TH QUARTER
JANUARY, 2003

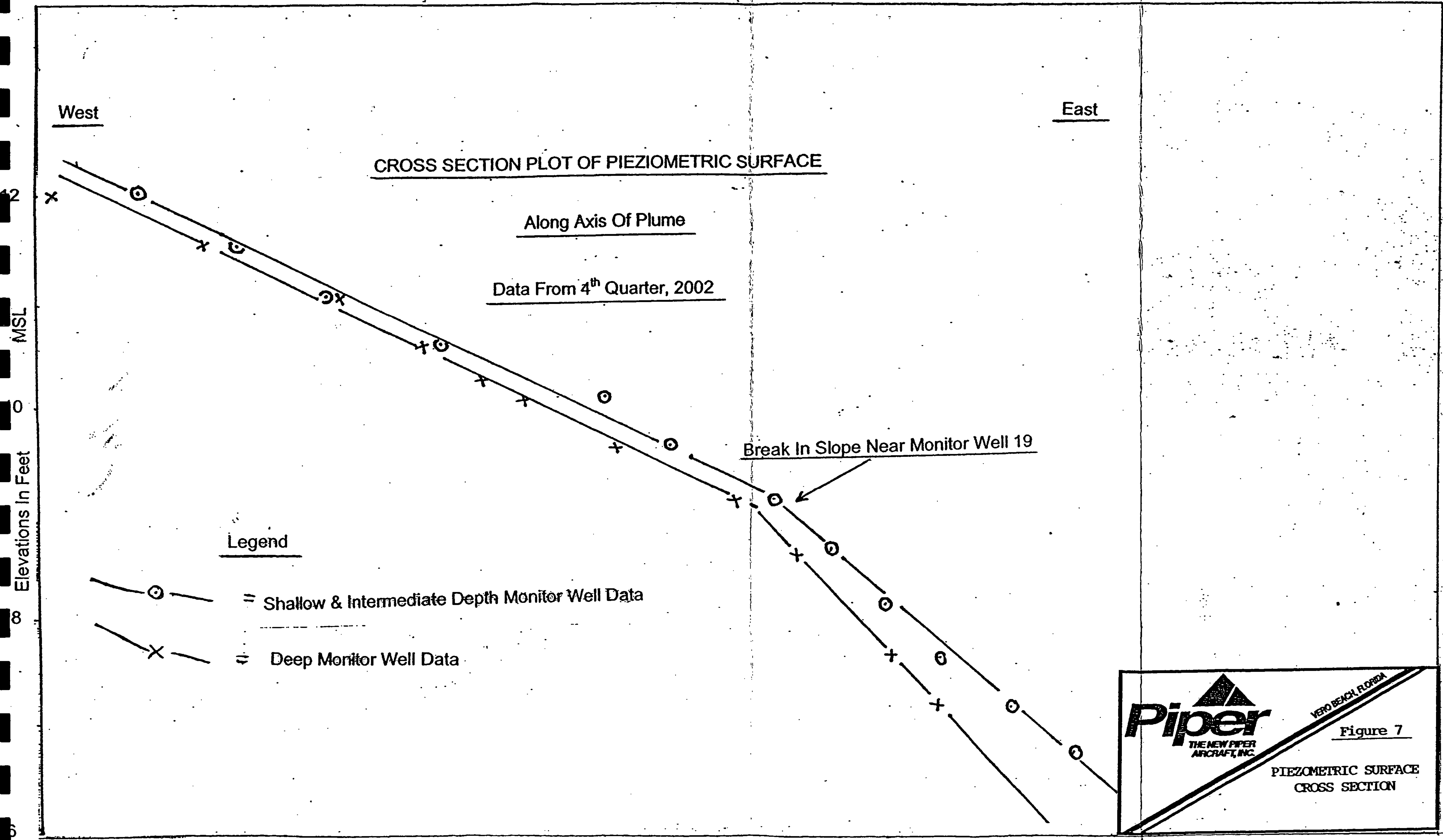
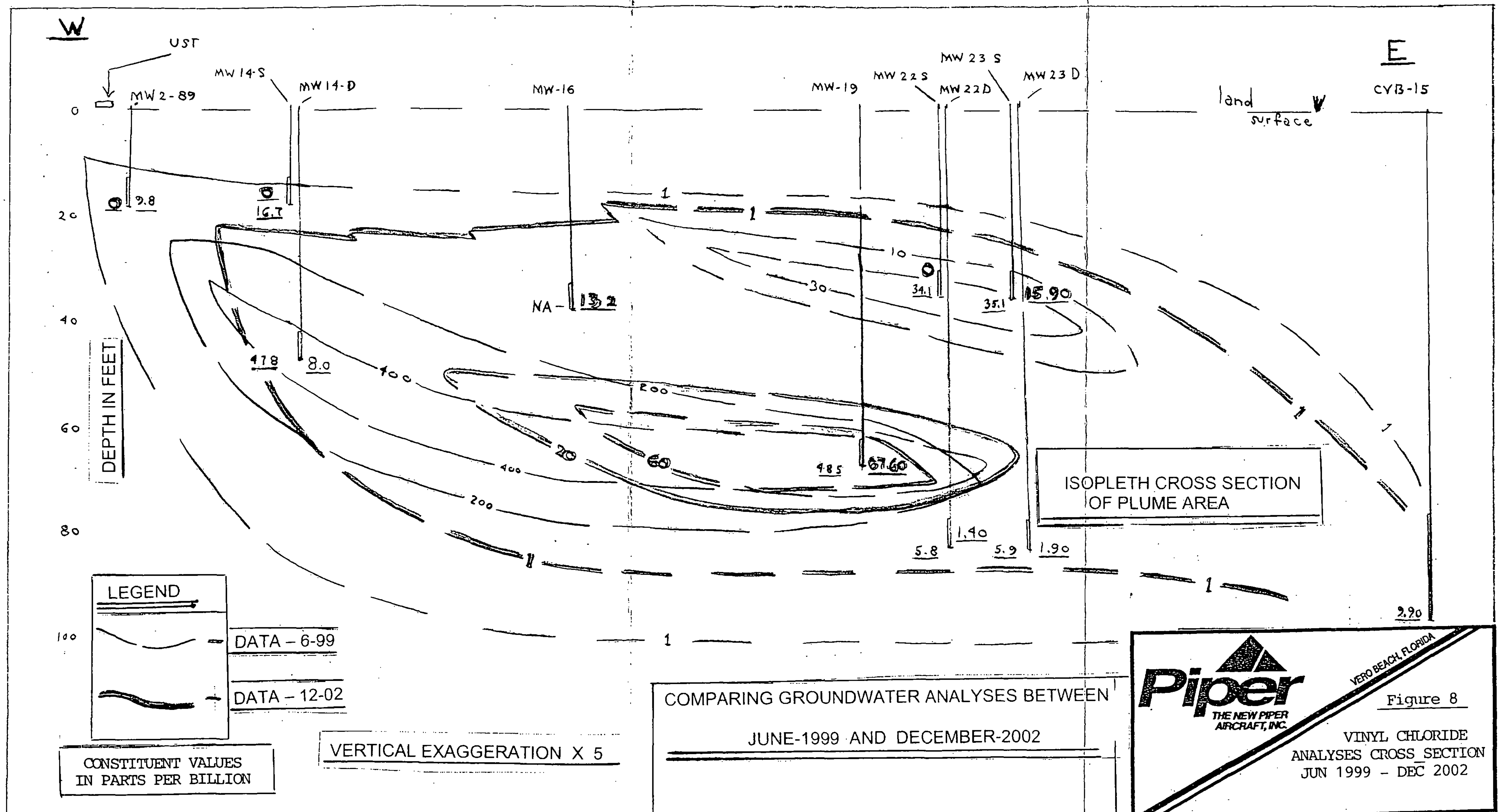
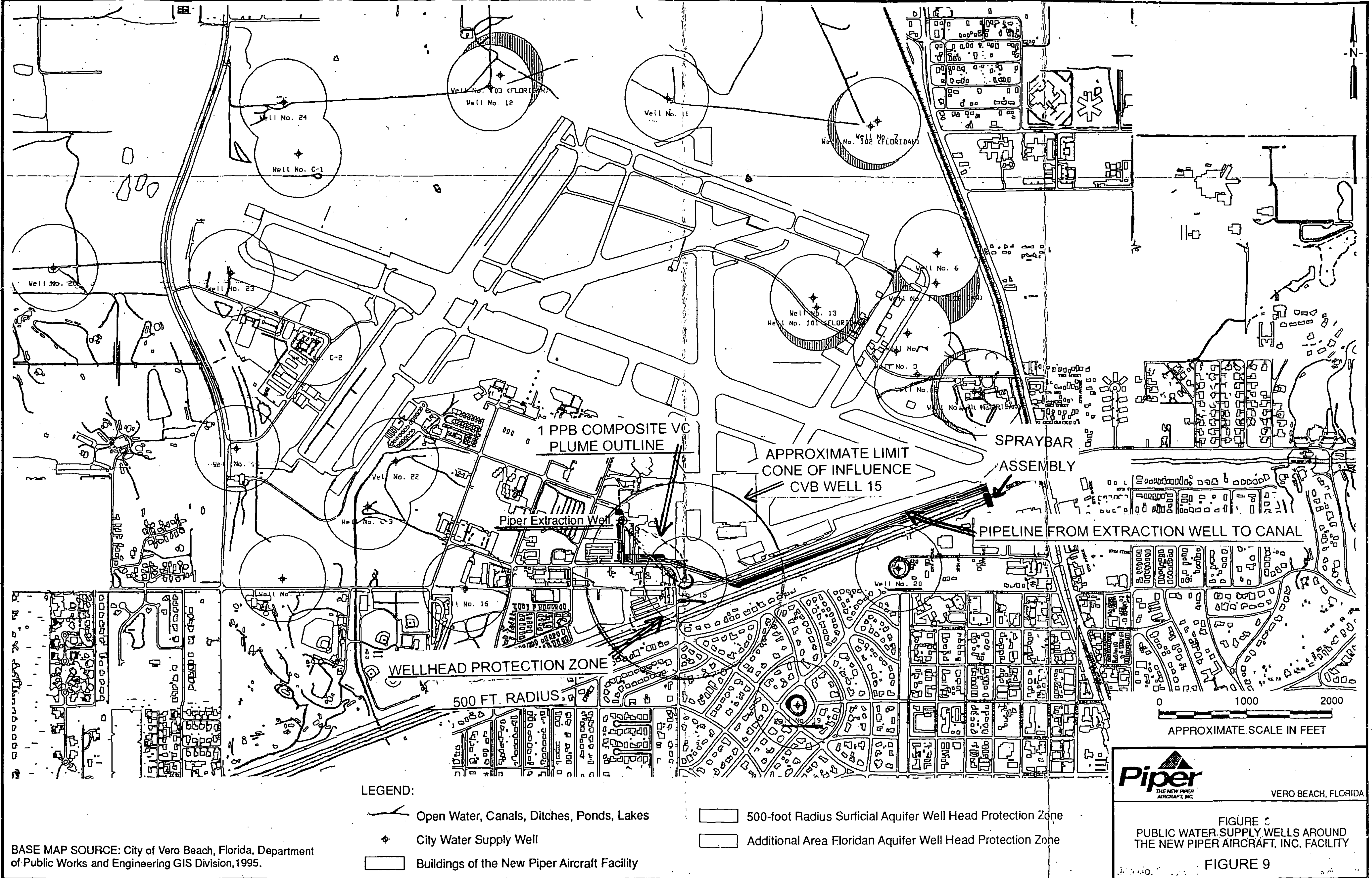


Figure 7

PIEZOMETRIC SURFACE CROSS SECTION


W
E
UST
MW2-89
MW14-S
MW14-D
MW-16
MW-19
MW22S
MW22D
MW23S
MW23D
CYB-15
land surface
0
20
40
60
80
100
DEPTH IN FEET
0
9.8
0
16.7
478
8.0
NA - 13.2
485
67.60
34.1
0
35.1
15.90
5.8
1.40
5.9
1.90
2.90
1
10
30
200
400
20
60
ISOPLETH CROSS SECTION OF PLUME AREA
LEGEND
DATA - 6-99
DATA - 12-02
CONSTITUENT VALUES IN PARTS PER BILLION
VERTICAL EXAGGERATION X 5
COMPARING GROUNDWATER ANALYSES BETWEEN
JUNE-1999 AND DECEMBER-2002
Piper
THE NEW PIPER AIRCRAFT, INC.
VERO BEACH, FLORIDA
Figure 8
VINYL CHLORIDE
ANALYSES CROSS SECTION
JUN 1999 - DEC 2002

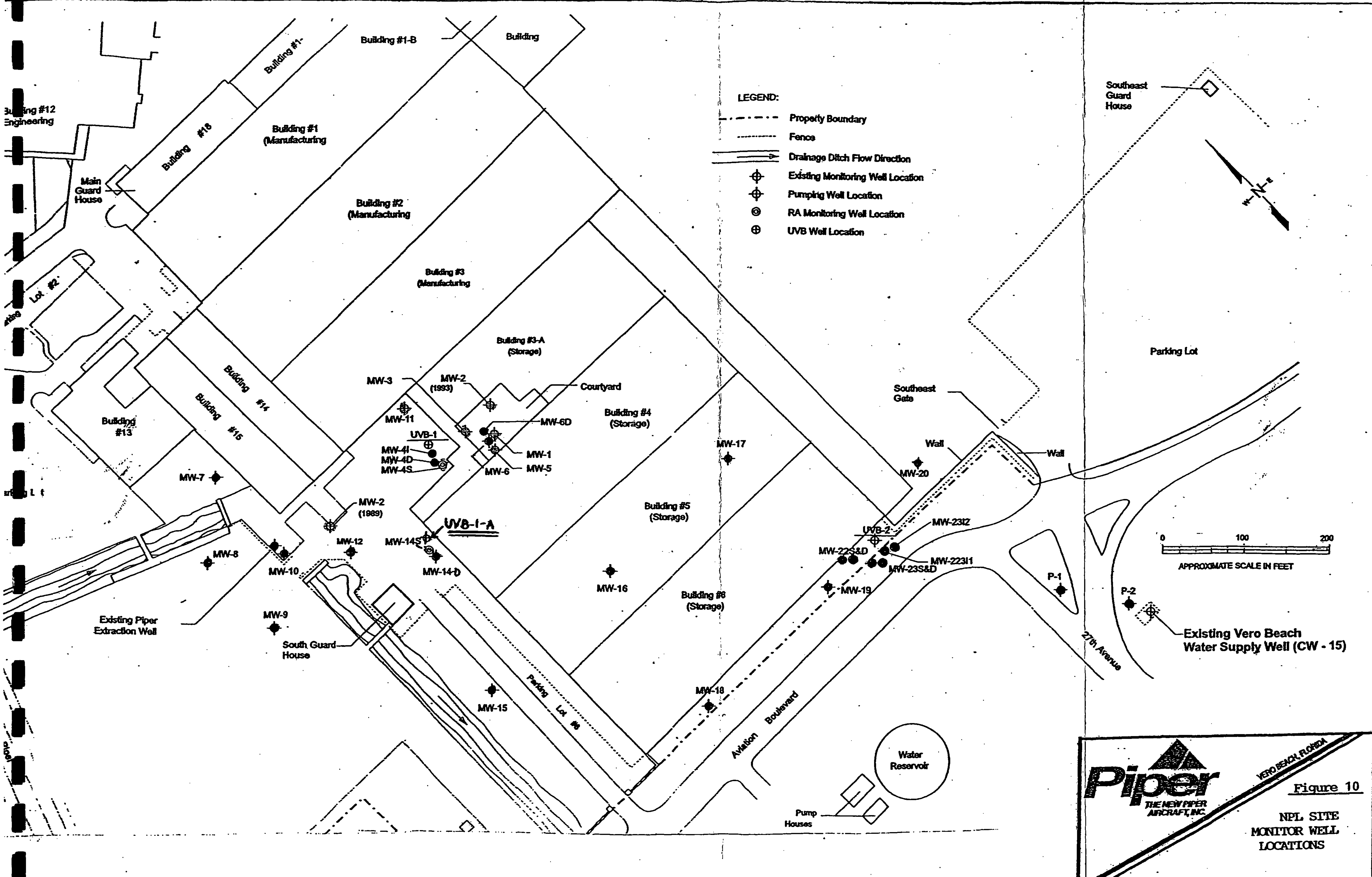


BASE MAP SOURCE: City of Vero Beach, Florida, Department of Public Works and Engineering GIS Division, 1995.

Piper
THE NEW PIPER AIRCRAFT, INC.
VERO BEACH, FLORIDA

FIGURE 9

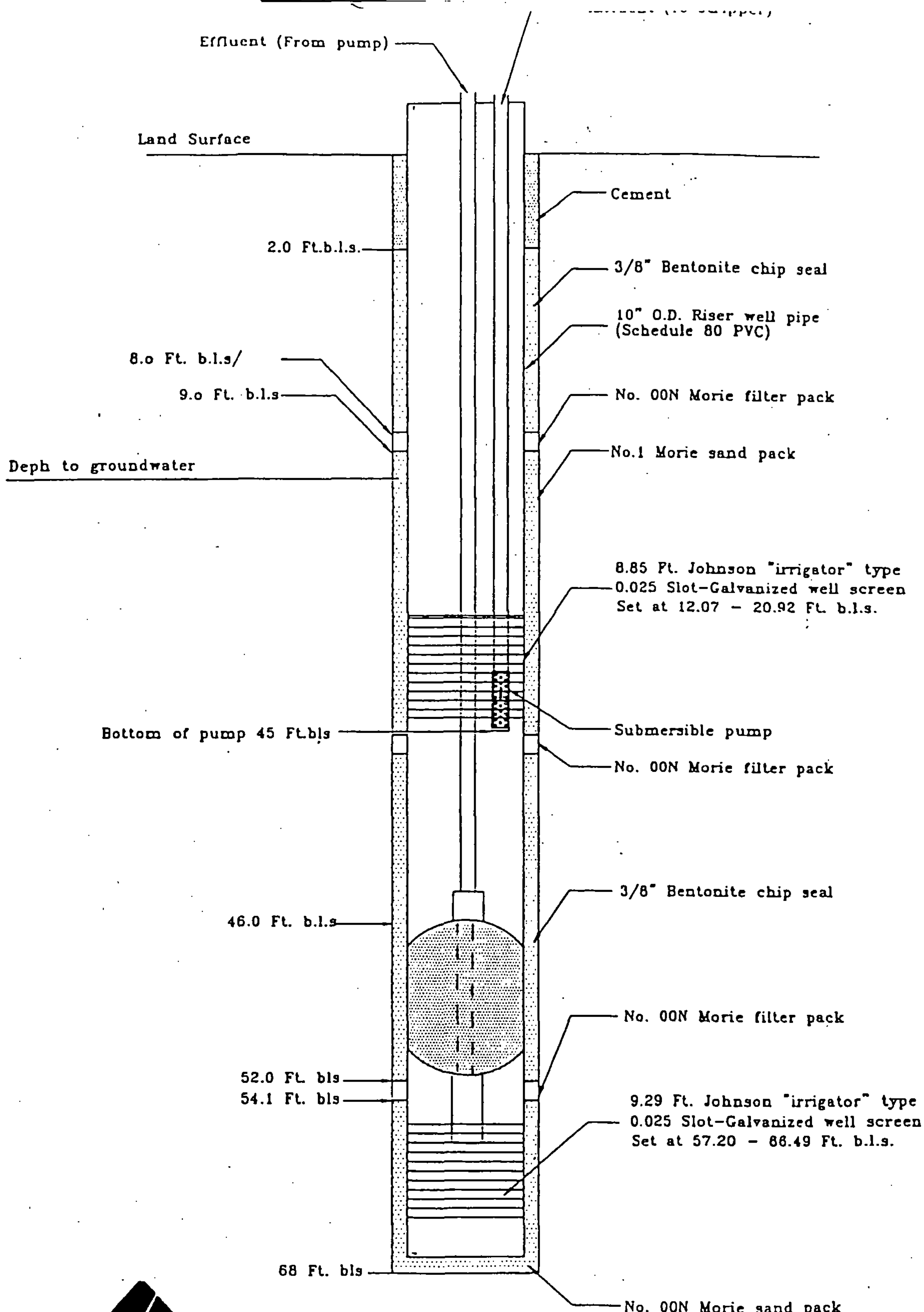
PUBLIC WATER SUPPLY WELLS AROUND THE NEW PIPER AIRCRAFT, INC. FACILITY



Piper THE NEW PIPER AIRCRAFT, INC. VERO BEACH, FLORIDA

Figure 10

NPL SITE MONITOR WELL LOCATIONS

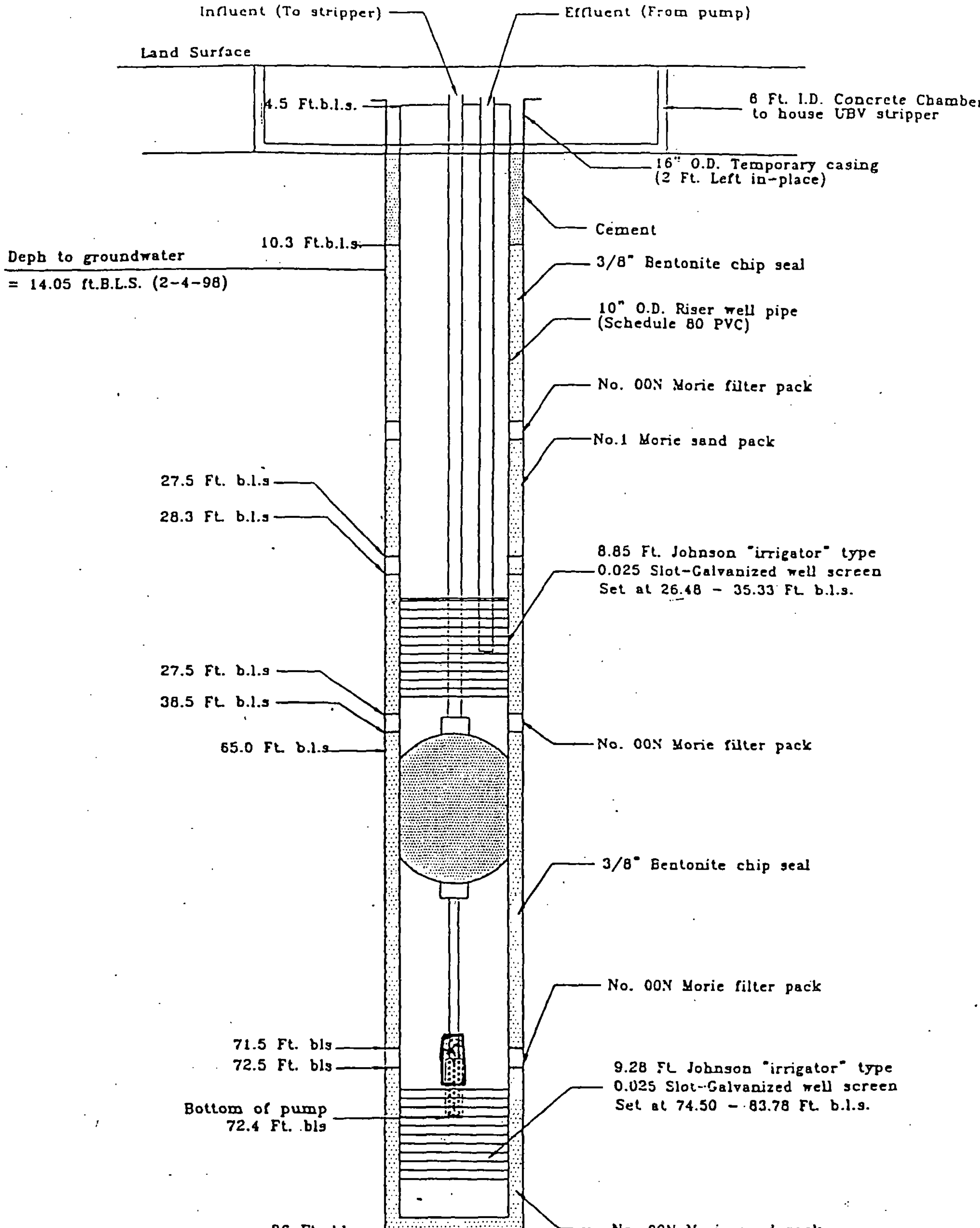


Piper
THE NEW PIPER AIRCRAFT, INC.

2926 Piper Drive,
Vero Beach, FL 32960

RECIRCULATING WELL
CONSTRUCTION DETAIL
UVB-1

FIGURE 11



Piper
THE NEW PIPER AIRCRAFT, INC.

RECIRCULATING WELL
CONSTRUCTION DETAIL
UVB-2

2926 Piper Drive,
Vero Beach, FL 32960

FIGURE 12

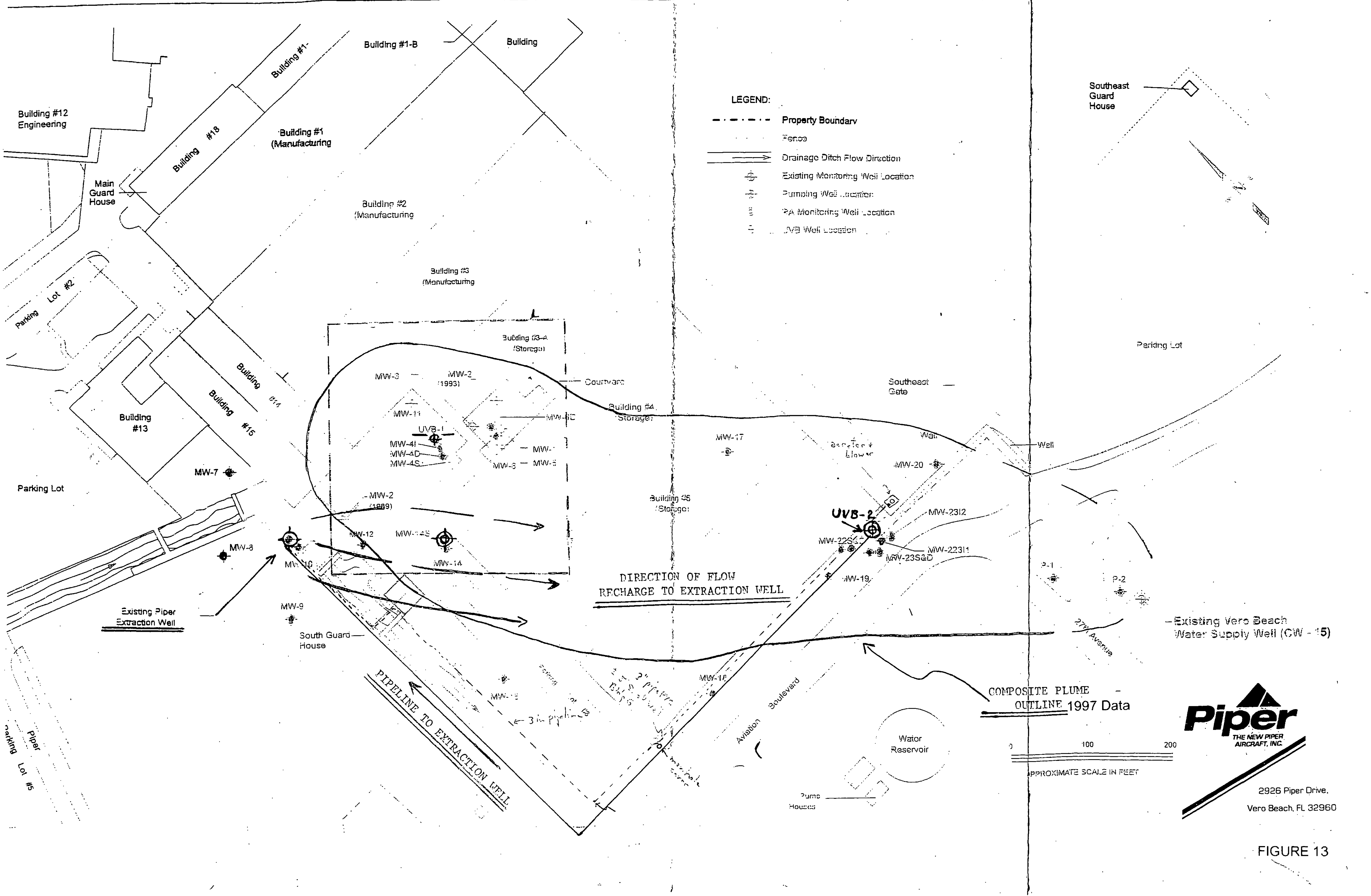
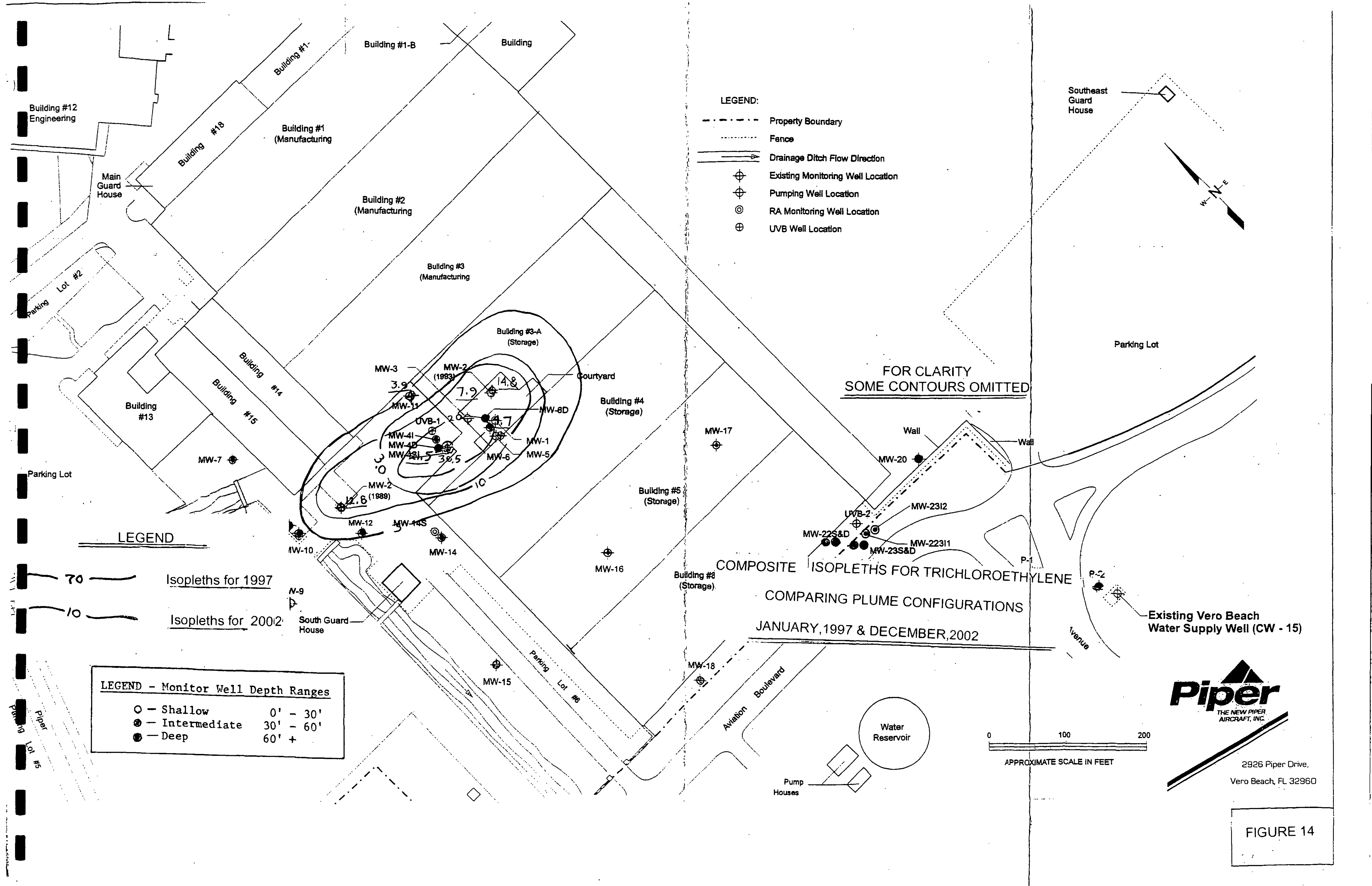
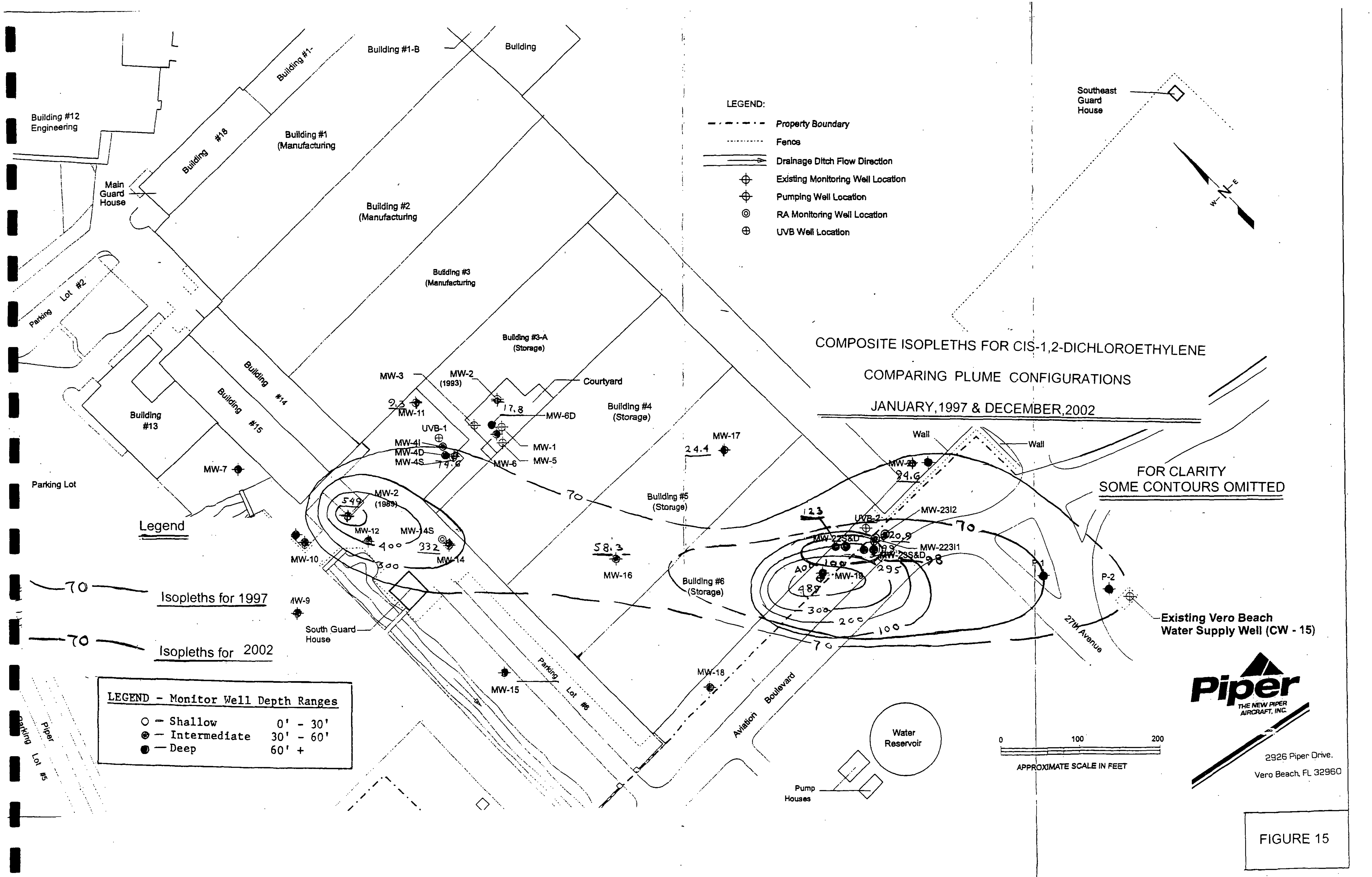

LEGEND:
Property Boundary
Fence
Drainage Ditch Flow Direction
Existing Monitoring Well Location
Pumping Well Location
PA Monitoring Well Location
UVB Well Location
Building #12 Engineering
Building #18
Building #1-
Building #1 (Manufacturing
Building #1-B
Building
Building #2 (Manufacturing
Building #3 (Manufacturing
Building #3-A (Storage)
Building #4 Storage)
Building #5 (Storage)
Building #13
Building #14
Building #15
Main Guard House
Parking Lot #2
Parking Lot
Courtyard
Southeast Guard House
Southeast Gate
Parking Lot
South Guard House
Piper Parking Lot #5
Water Reservoir
Pump House
Aviation Boulevard
27th Avenue
Well
MW-3
MW-2 (1993)
MW-11
UVB-1
MW-4I
MW-4D
MW-4S
MW-2 (1989)
MW-12
MW-14
MW-7
MW-8
MW-9
MW-10
MW-17
MW-20
MW-19
MW-23I2
MW-23I1
MW-23S&D
UVB-2
P-1
P-2
DIRECTION OF FLOW
RECHARGE TO EXTRACTION WELL
PIPELINE TO EXTRACTION WELL
Existing Piper Extraction Well
Existing Vero Beach Water Supply Well (CW - 15)
COMPOSITE PLUME OUTLINE 1997 Data
0
100
200
APPROXIMATE SCALE IN FEET
Piper
THE NEW PIPER AIRCRAFT, INC.
2926 Piper Drive.
Vero Beach, FL 32960

FIGURE 13


COMPOSITE ISOPLETHS FOR TRICHLOROETHYLENE
COMPARING PLUME CONFIGURATIONS
JANUARY,1997 & DECEMBER,2002
FOR CLARITY
SOME CONTOURS OMITTED
LEGEND:
Property Boundary
Fence
Drainage Ditch Flow Direction
Existing Monitoring Well Location
Pumping Well Location
RA Monitoring Well Location
UVB Well Location
LEGEND
70 Isopleths for 1997
10 Isopleths for 2002
LEGEND - Monitor Well Depth Ranges
O — Shallow 0' - 30'
— Intermediate 30' - 60'
— Deep 60' +
Building #12 Engineering
Main Guard House
Building #18
Building #1 (Manufacturing
Building #1-B
Building
Building #2 (Manufacturing
Building #3 (Manufacturing
Building #3-A (Storage)
Courtyard
Building #4 (Storage)
Building #5 (Storage)
Building #8 (Storage)
Building #13
Building #14
Building #15
Parking Lot #2
Parking Lot
Parking Lot #6
Piper Parking Lot #5
South Guard House
Southeast Guard House
Wall
Aviation Boulevard
Avenue
Water Reservoir
Pump Houses
Existing Vero Beach Water Supply Well (CW - 15)
MW-1
MW-2 (1993)
MW-2 (1989)
MW-3
MW-4I
MW-4D
MW-4S
MW-5
MW-6
MW-6D
MW-7
MW-9
MW-10
MW-11
MW-12
MW-14
MW-14S
MW-15
MW-16
MW-17
MW-18
MW-20
MW-22S&D
MW-23I2
MW-223I1
MW-23S&D
UVB-1
UVB-2
P-1
P-2
3.9
7.9
14.8
4.7
21.5
30.5
3.0
12.6
10
0 100 200
APPROXIMATE SCALE IN FEET
Piper
THE NEW PIPER AIRCRAFT, INC.
2926 Piper Drive,
Vero Beach, FL 32960
FIGURE 14


COMPOSITE ISOPLETHS FOR CIS-1,2-DICHLOROETHYLENE
COMPARING PLUME CONFIGURATIONS
JANUARY, 1997 & DECEMBER, 2002
FOR CLARITY
SOME CONTOURS OMITTED
LEGEND:
Property Boundary
Fence
Drainage Ditch Flow Direction
Existing Monitoring Well Location
Pumping Well Location
RA Monitoring Well Location
UVB Well Location
Legend
70 Isopleths for 1997
70 Isopleths for 2002
LEGEND - Monitor Well Depth Ranges
Shallow 0' - 30'
Intermediate 30' - 60'
Deep 60' +
Building #12 Engineering
Building #1-B
Building
Building #1-
Building #18
Building #1 (Manufacturing
Building #2 (Manufacturing
Building #3 (Manufacturing
Building #3-A (Storage)
Building #4 (Storage)
Building #5 (Storage)
Building #6 (Storage)
Building #13
Building #14
Building #15
Courtyard
Main Guard House
South Guard House
Southeast Guard House
Parking Lot #2
Parking Lot
Parking Lot #6
Piper Parking Lot #5
Aviation Boulevard
27th Avenue
Wall
Water Reservoir
Pump Houses
Existing Vero Beach Water Supply Well (CW - 15)
MW-1
MW-2 (1993)
MW-2 (1989)
MW-3
MW-4I
MW-4D
MW-4S
MW-5
MW-6
MW-6D
MW-7
MW-9
MW-10
MW-11
MW-12
MW-14
MW-14S
MW-15
MW-16
MW-17
MW-18
MW-19
MW-22S&D
MW-23S&D
MW-22I1
MW-22I2
UVB-1
UVB-2
P-1
P-2
9.3
17.8
74.6
549
400
332
300
70
24.4
58.3
94.6
123
20.9
400
100
489
300
295
200
100
98
0 100 200
APPROXIMATE SCALE IN FEET
Piper
THE NEW PIPER AIRCRAFT, INC.
2926 Piper Drive,
Vero Beach, FL 32960
FIGURE 15

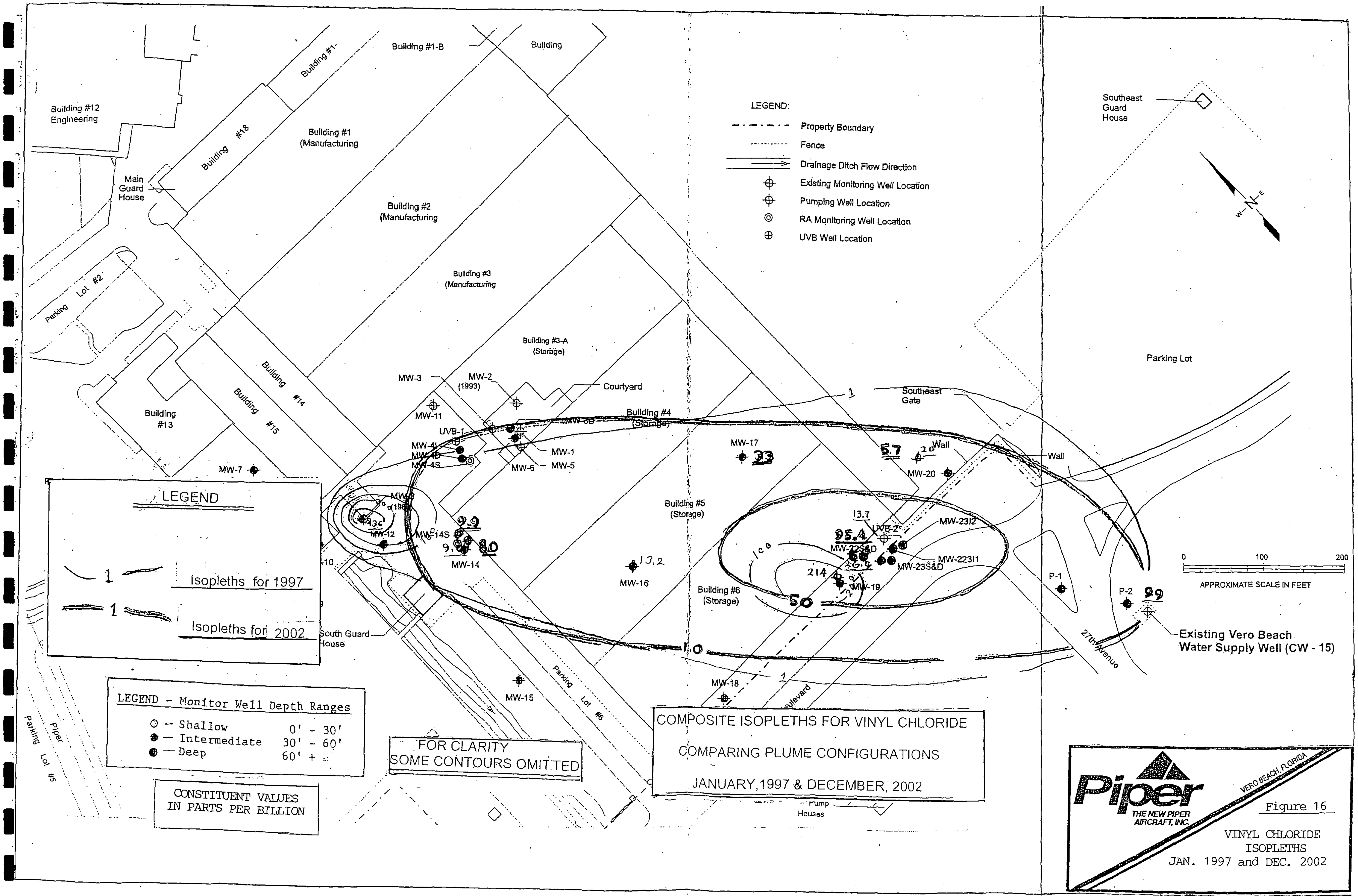
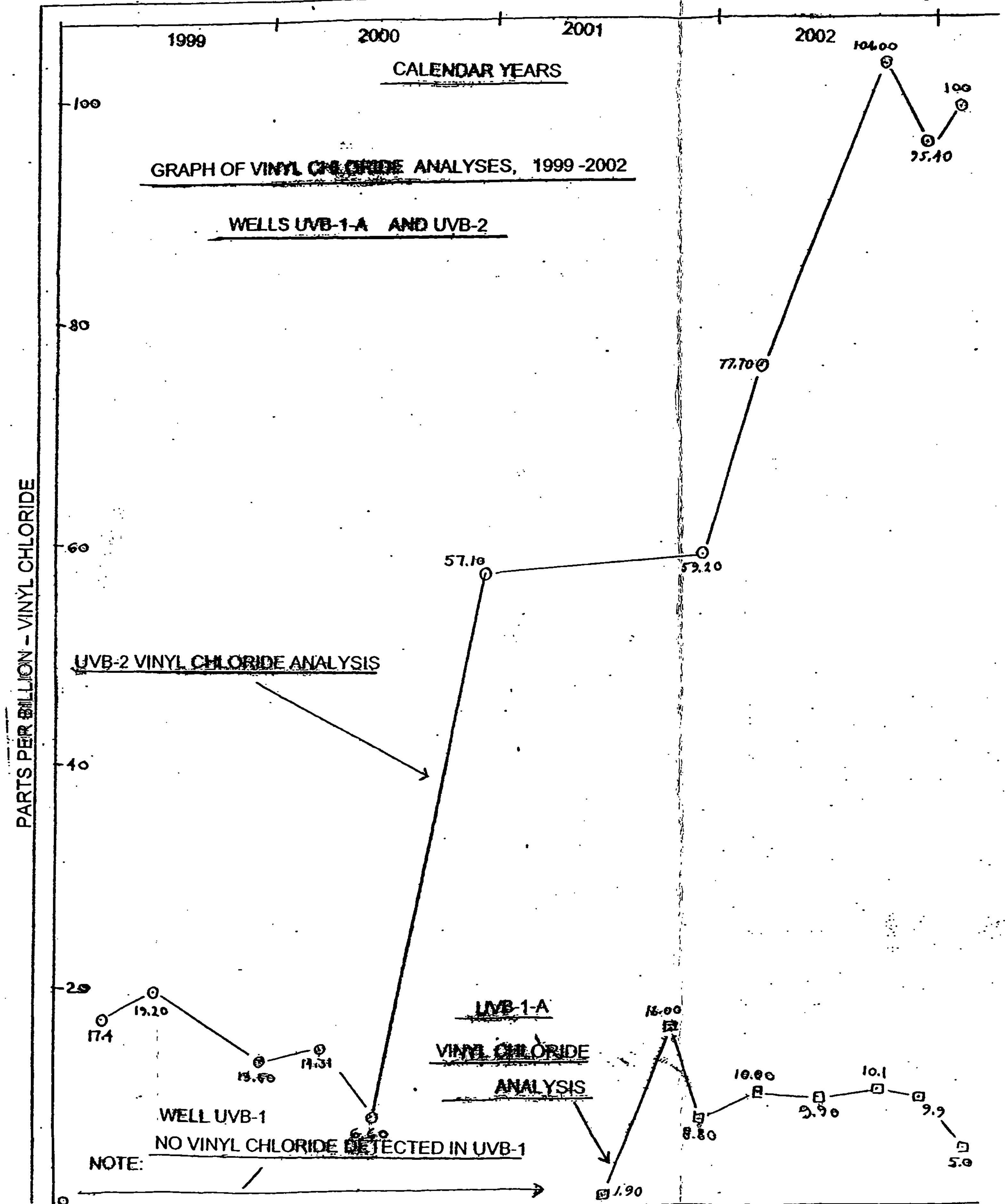


Figure 16

VINYL CHLORIDE ISOPLETHS

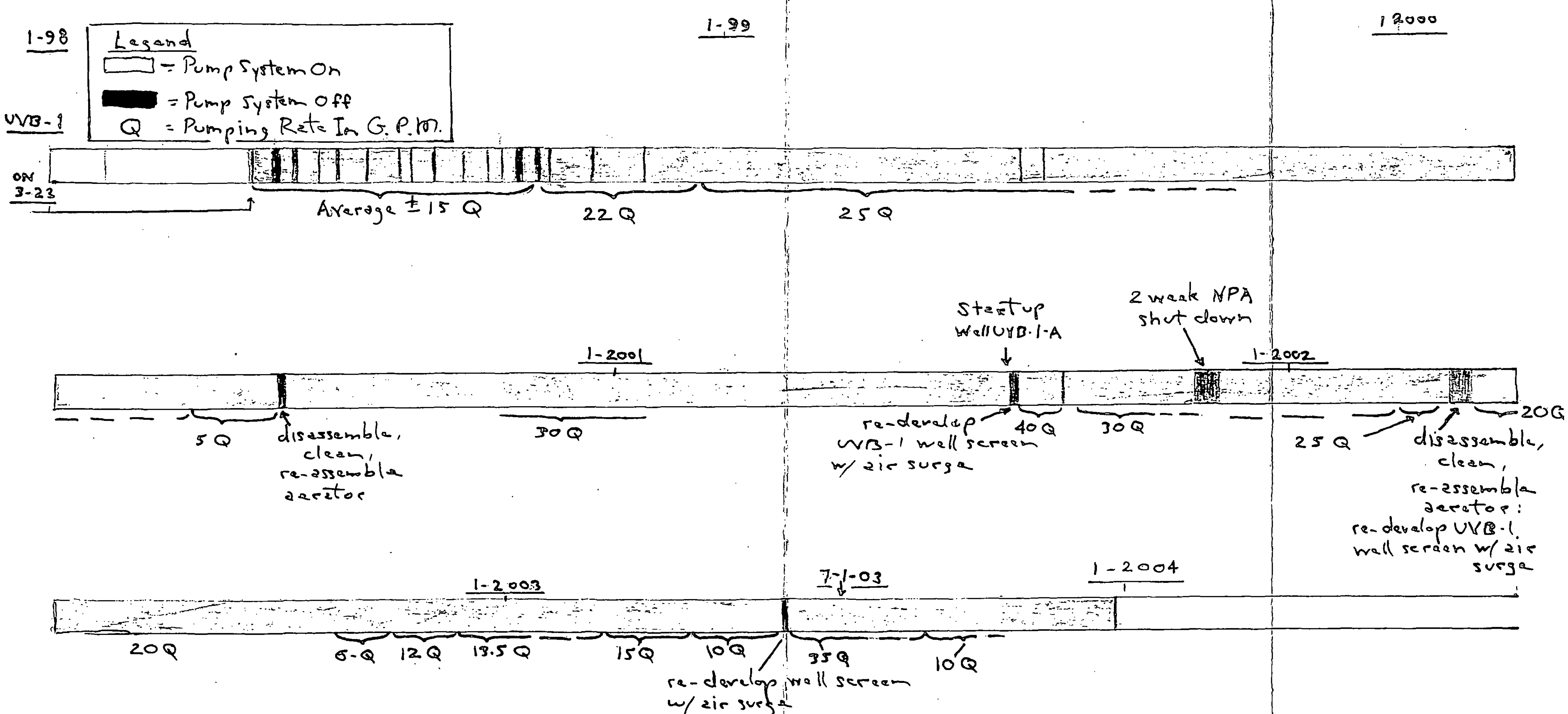
JAN. 1997 and DEC. 2002



Piper
THE NEW PIPER AIRCRAFT, INC.
VERO BEACH, FLORIDA

Figure 17

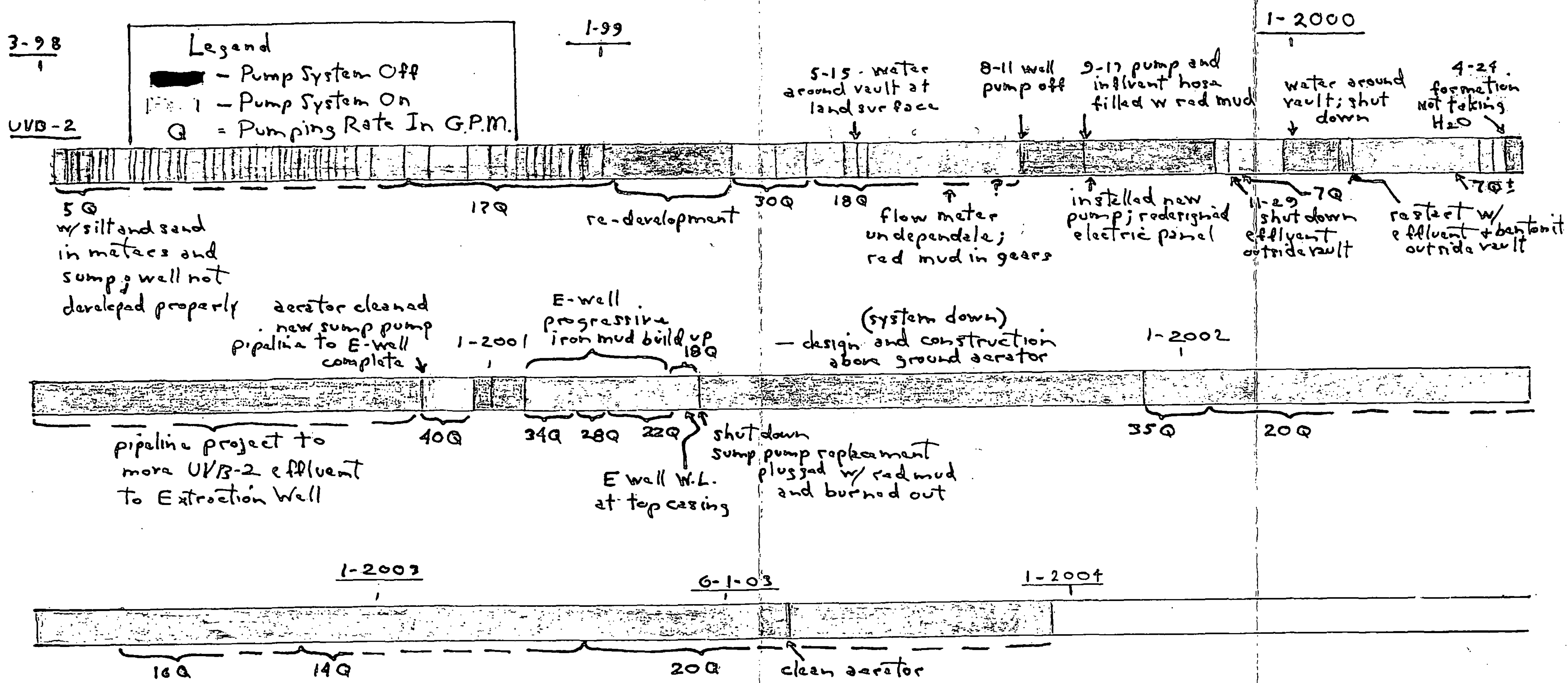
UVB-1 / UVB-2
VINYL CHLORIDE
ANALYSES 1999 - 2002



WELL UVB-1

FIVE YEAR OPERATIONAL HISTORY

FIGURE 18



WELL UVB-2

FIGURE 19

FIVE YEAR OPERATIONAL HISTORY

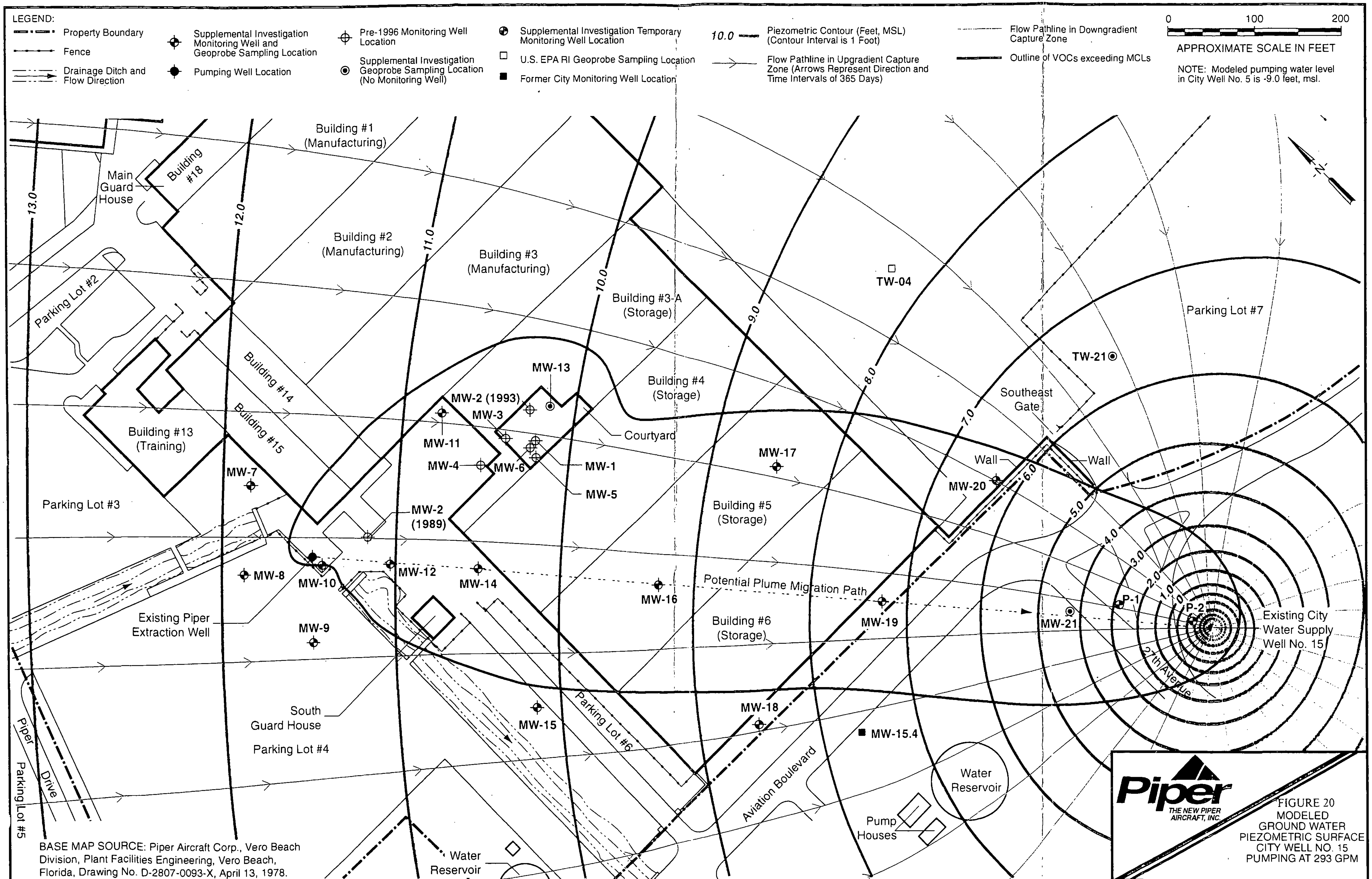


FIGURE 20
MODELED GROUND WATER PIEZOMETRIC SURFACE
CITY WELL NO. 15
PUMPING AT 293 GPM

BASE MAP SOURCE: Piper Aircraft Corp., Vero Beach Division, Plant Facilities Engineering, Vero Beach, Florida, Drawing No. D-2807-0093-X, April 13, 1978.

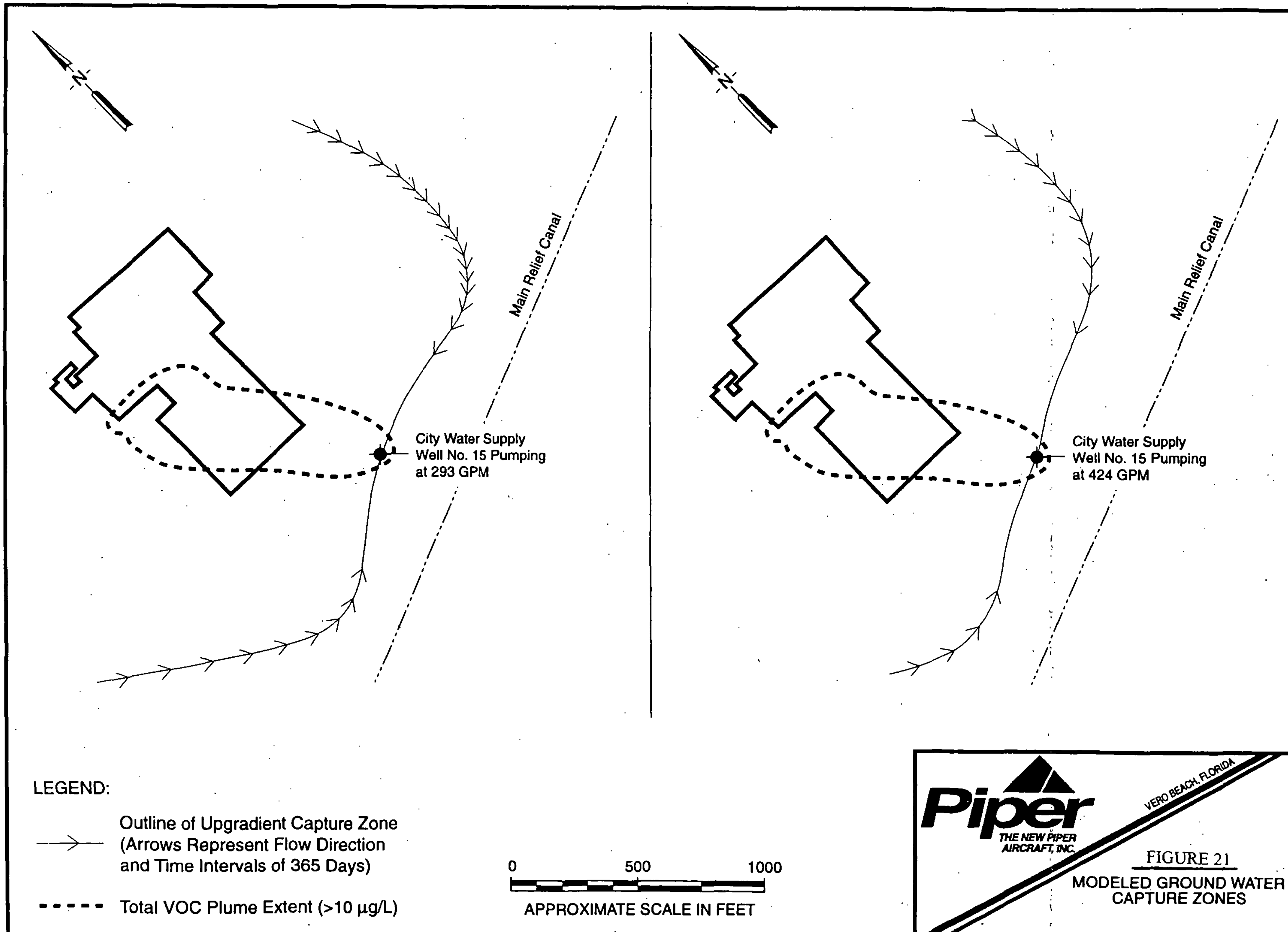
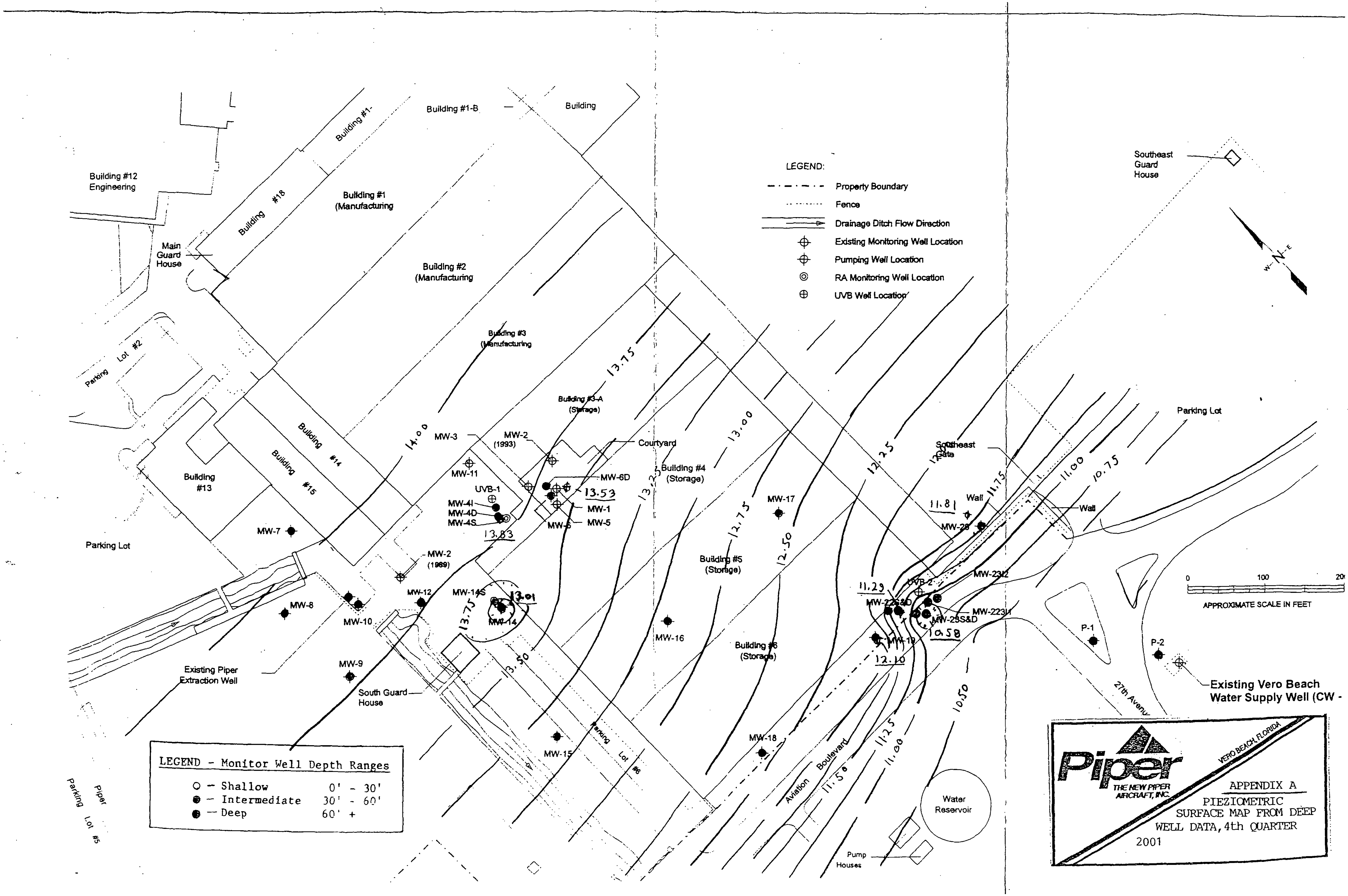


FIGURE 21
MODELED GROUND WATER
CAPTURE ZONES

APPENDIX

A



LEGEND:
Property Boundary
Fence
Drainage Ditch Flow Direction
Existing Monitoring Well Location
Pumping Well Location
RA Monitoring Well Location
UVB Well Location
LEGEND - Monitor Well Depth Ranges
Shallow 0' - 30'
Intermediate 30' - 60'
Deep 60' +
Piper
THE NEW PIPER AIRCRAFT, INC.
VERO BEACH, FLORIDA
APPENDIX A
PIEZIOMETRIC SURFACE MAP FROM DEEP WELL DATA, 4th QUARTER 2001
APPROXIMATE SCALE IN FEET
0
100
Existing Vero Beach Water Supply Well (CW -
Southeast Guard House
Building #12 Engineering
Main Guard House
Building #18
Building #1-
Building #1-B
Building
Building #1 (Manufacturing
Building #2 (Manufacturing
Building #3 (Manufacturing
Building #3-A (Storage)
Building #4 (Storage)
Building #5 (Storage)
Building #6 (Storage)
Building #13
Building #14
Building #15
Courtyard
Parking Lot #2
Parking Lot
Parking Lot #6
Piper Parking Lot #5
South Guard House
Existing Piper Extraction Well
Southeast Gate
Wall
Water Reservoir
Pump Houses
Aviation Boulevard
27th Avenu
Parking Lot
MW-1
MW-2 (1993)
MW-2 (1989)
MW-3
MW-4I
MW-4D
MW-4S
MW-5
MW-6D
MW-7
MW-8
MW-9
MW-10
MW-11
MW-12
MW-14S
MW-14
MW-15
MW-16
MW-17
MW-18
MW-19
MW-22S&D
MW-23I2
MW-223I
MW-23S&D
MW-28
UVB-1
UVB-2
P-1
P-2
14.00
13.75
13.50
13.25
13.00
12.75
12.50
12.25
11.75
11.50
11.25
11.00
10.75
10.50
13.83
13.53
13.01
11.81
11.29
12.10
10.58

APPENDIX B

AIR PERMITS

According to Mr. John Turner of the Florida Department of Environmental Protection's Central District Office in Orlando, the remedial work at the facility may be exempt from air permits due to either an insignificant emission source, the use of an air stripper or the emission of less than eight tons per year of volatile organics. SBP will write a letter to FDEP stating the mechanics of the remedial system and showing the off-gas emission mass flow calculations and requesting exemption. FDEP will respond in writing regarding the status of the site's exemption. SBP will ensure that Piper receives copies of all such correspondence.

In addition, as stated in the Record of Decision (December 1993), the air emissions from the treatment system shall comply with the EPA Office of Solid Waste and Emergency Response Directive 9355.0-28 titled Control of Air Emissions from Superfund Air Strippers from Superfund Ground Water Sites. This guidance document indicates that air emission sources need controls if their actual emission rates for total VOCs exceed 3 pounds per hour or 15 pounds per day or 10 tons per year.

Based on design calculations, SBP estimates a pumping rate for each UVB circulation well of 22 gallons per minute (122,760 liters per day). Using the highest concentrations reported in groundwater for each of the VOCs detected at the site from the Supplemental Investigation for Preliminary Remedial Design (Table G-1), the following maximum concentrations are assumed to be removed/volatilized through the *in situ* stripping process:

Parameter	Concentration (µg/L)
Trichloroethene	480
Vinyl Chloride	480
cis-1,2-Dichloroethene	2,700
trans-1,2-Dichloroethene	46
Tetrachloroethene	2
1,1-Dichloroethene	10
1,1-Dichloroethane	3
TOTAL VOCs	3,721 µg/L

Assuming a maximum VOC concentration of 3,721 µg/L (3.72 mg/L), a pumping rate of 122,760 liters per day, and 100% removal of VOC from the groundwater, the following mass flow can be calculated:

Mass Flow = Concentration x Pumping Rate x Stripping Efficiency
= 3.721 mg/L x 122,760 L/d x 100% = 456,800 mg/day or 456.8 g/day
456.8 g/day = 1.10 lbs/day

Even if the maximum total VOC concentration in groundwater was twice as high as the total VOCs used in this calculation, the off-gas emissions would double to approximately 2 lbs/day, the emission levels are well below the established air emission standards. Therefore, no off-gas treatment or permitting is proposed.

APPENDIX C

TABLE B-1

CONCENTRATION OF CONTAMINANTS AT THE EXTRACTION WELL AND AERATED EFFLUENT SITES

THE NEW PIPER AIRCRAFT, INC. - VERO BEACH, FLORIDA

Year	Month	Piper Extraction Well			
		TCE	1,1-DCE	1,2-DCE	Vinyl Chloride
1981	April	3,006	20.2	984	174
	July	8,734	62.3	2,449	528
	October	6,184	81.1	2,793	388
1982	January	2,591	123	3,738	495
	April	876	110	2,764	266
	July	281	37.9	1,934	535
	October	245	21.4	1,490	250
1983	January	163	24.5	1,169	286
	April	172	15.1	2,177	462
	July	125	14.3	1,609	186
	October	159	12.3	1,157	215
1984	January	145	8.2	993	264
	April	128	7.74	1,248	205
	July	121	11.4	1,385	211
	October	153	8.24	1,025	174
1985	January	128	10.6	870	144
	April	228	12.5	1,392	120
	July	115	4.85	1,357	131
	October	133	1.83	895	105
1986	January	139	8.97	497	98.0
	April	104	6.1	468	88.0
	July	68.6	7.79	335	92.4
	October	28.6	8.72	439	90.3
1987	January	75.3	11.0	267	105
	April	104	13.6	510	58.2
	July	101	17.4	724	132
	October	54.9	27.3	991	120
1988	January	46.9	14.2	664	135
	April	38.0	6.48	795	145
	July	20.0	9.36	563	87.0
	October	41.4	9.53	451	131
1989	January	29.1	6.75	231	46.0
	April	29.4	9.12	244	131
	July	18.3	6.69	546	136
	October	35.0	26.4	34	116

		Piper Extraction Well			
Year	Month	TCE	1,1-DCE	1,2-DCE	Vinyl Chloride
1990	January	110	3.00	379	112
	April	39.5	9.74	345	105
	July	79.7	6.62	311	115
	October	170	4.75	546	63.2
1991	January	80.4	4.48	361	61.9
	April	89.4	3.13	357	67.8
	July	49.5	5.44	361	64.3
	December	37.9	3.62	447	58.9
1992	February	28.1	4.76	242	38.8
	April	11.4	2.41	2.07	39.7
	July	7.17	2.63	69.8	28.9
	November	53.9	1.59	22.9	29.0
1993	January	30.2	ND	154.4	34.5
	April	12.8	1.66	173	32.8
	July	11.4	ND	165	25.9
	October	5.66	ND	134	25.7
1994	January	3.13	ND	109	28.9
	April	6.52	1.21	117	26.9
	September	1.78	ND	100	19.8
	October	3.4	ND	120	24.0
1995	January	-	-	-	-
	February (L)	-	-	-	-
	February (H)	-	-	-	-
	March (14)	-	-	-	-
	March (17)	-	-	-	-
	April	-	-	-	-
	May	-	-	-	-
	June	-	-	-	-
	July	-	-	-	-
	August	-	-	-	-
	September	-	-	-	-
	October	-	-	-	-
	November	-	-	-	-
	December	-	-	-	-

All values in µg/L
Data provided by Harbor Branch Environmental Laboratory
\- = Sample not collected

Note: Extraction well shutdown for mechanical problems Jan.-1996 and not used after that date.

APPENDIX D

APPENDIX D

CAPTURE ZONE ANALYSIS

Dames & Moore, Inc. modeled the capture zone of City of Vero Beach Well #15 using aquifer coefficients established during the aquifer pumping test. To assist in the modeling effort, Dames & Moore used TWODAN v. 4.0, a two-dimensional analytic element ground water flow modeling program (Fitts 1993). The computer model was set up having the following parameters:

- Ground surface elevation of 21 feet msl.
- Base of aquifer at elevation - 79 feet msl - aquifer thickness 100 feet.
- Aquifer transmissivity $T = 2{,}800$ ft^2/day.
- The Main Relief Canal, located 300 feet south of City of Vero Beach Well #15, was modeled as a constant head boundry having a value of 8.0 msl.

The model was calibrated by running it with three configurations of pumping wells and comparing the output to measured piezometric surfaces. The initial calibration run was with a non-pumping configuration (i.e., the NewPiper Extraction Well and City of Vero Beach Well #15 were shut off). The modeled piezometric surface from the non-pumping calibration run closely matched the piezometric surface measured on November 16, 1996. Two calibration runs were made using the pumping configurations during the July 17, 1996 ground water levels measurement event (NewPiper Extraction Well operating at 77 gpm) and the July 31, 1996 measurement event (Vity of Vero Beach Well #15 operating at 325 gpm). The modeled piezometric surfaces closely matched the measured surfaces on these days.

The capture zone of City of Vero Beach Well #15 was modeled using a discharge equal to this well's 1996 average discharge of 293 gpm, no pumping at the NewPiper Extraction Well, and steady state conditions. Pumping at City of Vero Beach Well #15 at a discharge of 293 gpm induces a cone of depression in the vicinity of the southeastern part of the site, and the ground water capture zone at this rate encompasses the entire extent of the VOCs plume. The capture zone of the City of vero Beach Well #15 was also modeled using a discharge equal to the maximum discharge currently available for this well, 424 gpm (i.e., the discharge used during the aquifer performance test) no pumping of the NewPiper Extraction Well, and steady state conditions. Pumping at City of Vero Beach Well #15 at a discharge of 424 gpm induces a cone of depression in the vicinity of the southeastern part of the site, and the ground water capture zone at thisrate encompasses the entire extent of the VOCs plume.

The modeled capture zones at the two pumping rates are not significantly different in the vicinity of the site. The primary difference between the pumping rate is the modeled rate at which the plume is captured. As shownby the arrows on the flow lines, (each arrow represents 1 year of time), at $Q = 293$ gpm, the plume is captured in approximately 5-years.

ADDITIONAL PRELIMINARY REMEDIAL DESIGN ACTIVITIES

The downgradient limit of ground water flow from the site is City of Vero Beach Well #15, and when this well is not operating, the downgradient limit is the Main Relief Canal. The two immediaent property owners downgradient of the VOCs plume beneath the NewPiper facility were contacted to inquire if they operate drinking water wells. Neither of the two private properties downgradient of the site have drinking water wells.

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

Department of Environmental Protection

Jeb Bush
Governor

Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

David B. Struhs
Secretary

September 26, 2003

Mr. Jim McGuire
USEPA, Region IV
Atlanta Federal Center
61 Forsyth St., SW
Atlanta, GA 30303-8960

Dear Mr. McGuire:

FDEP has reviewed the draft June 2003 Five-Year Review (Review) for the Piper Aircraft Superfund site. The following is based on an evaluation of the remedy as defined in the February 1993 Record of Decision (ROD) and the Remedial Action Objectives identified therein.

In the Technical Assessment of the Five-Year Review, the report concludes that the Re-Circulation Cell remedy has not performed at the flow rates or efficiency as designed and that it is unlikely that target cleanup levels will be attained within the next 5 year period without the use of a bio-remediation technology. Problems with iron fouling and the limited storage capacity in the surficial aquifer have resulted in the UVB –1 and –2 systems operating at 30% of their designed rate. Attempts to improve system performance include modifications to the former UVB wells for use as groundwater recovery wells with treatment and re-injection at other location(s) onsite. The report appears to recommend continued use of the modified UVB wells, with additional injection wells to accommodate increased effluent flow rates from UVB-1A and UVB-2 and the installation of equipment to reduce the iron content in the effluent. In addition, an accelerated bioremediation pilot is recommended.

Our review of the report and historical data has raised several concerns with regard to the effectiveness of the remedy, as currently operating, in reaching MCLs and preventing plume migration: 1) the continued off site migration of the contaminant plume in response to the down gradient operating municipal well CVB #15, as documented by CVB #15 monitoring data showing persistent vinyl chloride concentrations above the MCLs. 2) the possibility of a continuing source that is not being detected in the existing monitoring well configuration. 3) the future efficacy of using the UVB wells to reach remedial goals, considering the problems with iron fouling and the hydraulic limitations of the aquifer.

Continued off site migration of groundwater contaminants and contamination of a municipal well is of particular concern with regard to the effectiveness and protectiveness of the remedy. It should be confirmed that wellhead treatment is ongoing at the City of Vero Beach municipality.

In addition, a review of existing monitoring well construction specifications, historical direct push data, and current MW contaminant levels suggest that potential source areas may still exist and that the existing monitoring system may not reflect current contaminant conditions. The majority of monitoring wells in the former UTS source area are screened at depths of $\leq$ 35 feet BLS. Given the reported tank line leaks near the former solvent UST location, it is likely that DNAPL was present in groundwater. Therefore, one would expect to see groundwater samples from MW-2, -10 & -12 in this area with detectable concentrations of contaminants, rather than the detached down gradient contaminant plume as shown in the June 2003 Operating Report. Persistent TCE at concentrations above MCLs in the MW-4 cluster suggests a potential ongoing source . Historical flow patterns and the 1997 supplemental direct push (DP) data from DP-13 and MW-17 also suggest a potential source area.

We recommend the following:

- Collect additional groundwater samples using direct push profiling over discrete vertical intervals in the known or suspected source areas to better determine contaminant concentrations and distribution before any further remedial plans are made. Modifications to the remedy, such as enhanced bioremediation, should include focus on these source areas.

- If bioremediation is being considered as a future remedy, the following natural attenuation parameters need to be collected from select monitoring wells: dissolved oxygen, Redox, pH, temperature, ferrous iron, total iron, methane, ethene, ethane, sulfate, sulfite, nitrate, nitrite, and carbon dioxide. We also recommend collection of a few groundwater samples in the source area for analysis for Dehalococcoides ethanogenes (DHE). Current information indicates that the presence of this microorganism is essential to the complete degradation of chlorinated solvents from Cis through vinyl chloride to ethene/ethane.

- Installation of an off site down gradient monitoring well or monitoring well cluster outside of the influence of UVB-2 to monitor the effectiveness of the remedy in containing the plume and guide in the evaluation of other remedial technologies.

We request that FDEP be copied on all correspondence associated with the assessment and design of future remedial pilot studies, and welcome the opportunity to participate in the evaluation of possible remedial modifications.

Thank you for providing FDEP with the opportunity to participate in the Superfund Five-Year Review for this site. We understand that our comments will be appended to the final Five-Year Review Report.

Sincerely,

Kelsey A Helton

Kelsey A. Helton
Environmental Manager
Hazardous Waste Cleanup